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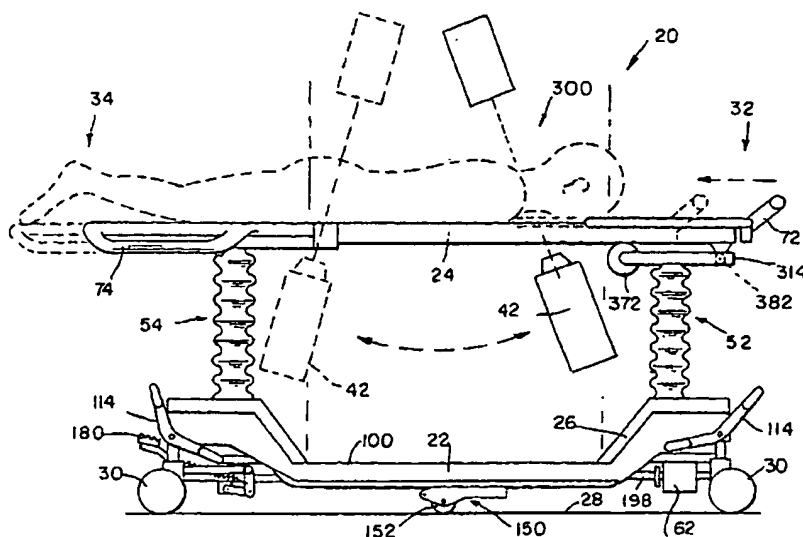
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(54) Title: IMAGING STRETCHER



(57) Abstract: A stretcher (20) includes a base (22) having a head end (32) and a foot end (34), a plurality of casters (30) coupled to the base (22), a radiolucent upper deck (24), head and foot end hydraulic cylinders (52, 54) coupled to the base (22) adjacent to the head and foot ends (32, 34) thereof, and head and foot end connectors (302, 304) for coupling the head and foot end hydraulic cylinders (52, 54) to the head and foot ends (32, 34) of the deck (24). The head and foot end connectors (302, 304) secure the deck (24) to the base (22) while allowing movement of the deck (24) between a low position and a high position, translation of the deck (24) toward the foot end of the base (22), and rotation of the deck (24) to a Trendelenburg position or to a reverse Trendelenburg position. The stretcher (20) forms a central imaging region free of structure that would interfere with imaging.

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IMAGING STRETCHERBackground and Summary of the Invention

The present invention generally relates to a hospital stretcher. More particularly, the present invention relates to an imaging stretcher which lends itself to fluoroscopy imaging.

Fluoroscopy imaging with a C-Arm is used by caregivers for diagnostic and surgical visualization. Many conventional imaging tables have designs based on operating room tables. Often these tables are of a cantilever design where the support surface extends out from a single support column. Such tables usually have all electric controls, are relatively large and heavy, and are also expensive. Typically, a room having an operating room-type table is set up in a medical facility, and a C-Arm is temporarily brought into the room when needed for fluoroscopic observations.

Due to increase in the number of outpatient centers and clinics, especially pain management clinics, a need has arisen for a low cost, transportable imaging stretcher. In pain management procedures, the patient is placed on a support surface in a prone position and a nerve-deadening solution is injected from a needle to precise areas of the spine. Fluoroscopy imaging with a C-Arm is used to determine the location of the needle in the patient during such procedures. The C-Arm must be positioned to visualize specific places on the spine which requires the C-Arm to be moved between the neck and the lower back of a patient resting on a support surface, tilted to odd angles, and rotated from a vertical to a horizontal orientation without obstruction from the surface supporting the patient. Caregivers will appreciate a low cost imaging stretcher which includes an unobstructed X-ray window from the tailbone to the head of a patient resting on the support surface, with the ability to angle and maneuver the C-Arm around and under the patient.

There are some stretchers on the market today that have a radiolucent top that can be used for C-Arm procedures, but have a relatively wide surface with metal structure down the sides that interfere with rotating the C-Arm and shooting an image horizontally or diagonally through a patient. Some of these stretchers have an upper deck or a litter that slides end to end to achieve a large X-ray window, but they

do not slide far enough so that the C-Arm can position under the head of a patient supported on the litter, and shoot an image diagonally through the neck without having to pull the C-Arm out from under the patient. Also in these stretchers, the C-Arm cannot be moved from the head to the lower back without obstruction. Some of these stretchers have a C-shaped base that allows C-Arm access from one side only.

An imaging stretcher according to the present invention includes a base having a head end and a foot end, an upper deck formed from a radiolucent material, and actuators coupled to the base adjacent to the head end and the foot end of the base respectively for movably supporting the upper deck. According to one aspect of the invention, the head end and foot end actuators are spaced wide apart to define a central imaging region above the base which is free of any components that would interfere with fluoroscopic imaging of a patient supported on the upper deck.

According to another aspect of the invention, the head end and foot end actuators are coupled to the upper deck such that the upper deck is movable toward the foot end of the base. According to a further aspect of the invention, the upper deck may be unlocked, moved to a desired position and locked in place. According to still another aspect of the invention, movement of the upper deck toward the foot end of the base locates the head of a patient supported on the deck between the head end and foot end actuators in the central imaging region. According to a further aspect of the invention, a portion of the base extending between the head end and foot end actuators is formed to be closer to the floor than the end sections thereof supporting the casters to provide more clearance between the upper deck and the base between the actuators in the central imaging region.

According to another aspect of the invention, the upper deck is movable between a lowered position and a raised position, and pivotable between a first position where the foot end of the upper deck is raised above the head end thereof (also known as Trendelenberg position) and a second position where the head end of the upper deck is raised above the foot end thereof (also known as reverse Trendelenberg position).

According to still further aspect of the invention, the upper deck is formed to include a cutout adjacent to the head end thereof to provide space for a patient's face lying in a prone position on the upper deck. According to another

aspect of the invention, the upper deck is formed to include a pair of openings adjacent to first and second sides thereof for supporting a pair of removable siderails. According to still another aspect of the invention, the upper deck is formed to include a plurality of handles which are also made of radiolucent material. According to a further aspect of the invention, the cutout, the openings for the siderails and the handles are all integrally molded with the upper deck.

According to another aspect of the invention, an elongated shaft having a longitudinal axis is coupled to the base for movement along the longitudinal axis. A foot pedal is movably mounted to the base adjacent to the foot end, and is configured to engage a portion of the shaft adjacent to the foot end to move the shaft toward the head end and cause the head end actuator to adjust the elevation of the head end of the upper deck. According to yet another aspect of the invention, the shaft is mounted to the base for rotation about the longitudinal axis between a first orientation and a second orientation. A steering wheel is coupled to the shaft for movement relative to the base between a first position spaced apart from the floor when the shaft is rotated to the first orientation and a second position engaging the floor when the shaft is rotated to the second orientation.

Additional features of the present invention will become apparent to those skilled in the art upon a consideration of the following detailed description of the preferred embodiments exemplifying the best mode of carrying out the invention as presently perceived.

#### Brief Description of the Drawings

The detailed description particularly refers to the accompanying figures in which:

Fig. 1 is a side view of an imaging stretcher according to the present invention, showing a relatively narrow upper deck supported above a relatively low profile base by a pair of hydraulic cylinders which are spaced wide apart to form a central imaging region free of any non-radiolucent components, the upper deck being mounted to the base for movement toward the foot end of the stretcher, and further showing in phantom the upper deck in a lowered position;

Fig. 2 is a side view similar to Fig. 1, showing the upper deck in a Trendelenberg position where a patient's feet are raised above the head;

Fig. 3 is a side view similar to Figs. 1 and 2, showing the upper deck in a reverse Trendelenberg position where a patient's head is raised above the feet;

5            Fig. 4 is a plan view of the stretcher of Figs. 1-3, showing the upper deck formed to include a push handle near the head end, a pair of downwardly sloping side handles near the foot end, a cutout near the head end to provide space for a patient's face lying in a prone position on the upper deck, a pair of armboards pivotally coupled near the head end of the upper deck for supporting a patient's arms,  
10           a pair of openings adjacent to the two sides of the upper deck for removably receiving a pair of siderails, and a cross bar near the head end of the upper deck for supporting one or more IV poles;

Fig. 5 is a plan view of the stretcher chassis without the upper deck and without a shroud covering the base, the base including two cross members held in  
15           longitudinally spaced-apart relationship by two longitudinally extending, laterally spaced siderails, a caster assembly coupled to each end of the two cross members, a cross plate attached to the two siderails at each end for supporting head end and foot end hydraulic pump/cylinder assemblies, a steering wheel support assembly movably coupled to the two siderails intermediate of the two cross members, a longitudinally  
20           extending, slidably mounted brake-steer shaft coupled to the steering wheel support assembly, a brake-steer butterfly pedal pivotally mounted at each end of the two cross members, head end and foot end pressure release pedals movably coupled to the base near the foot end, a foot pump pedal mounted to the base near the foot end and coupled to hydraulic pumps for pumping fluid into the hydraulic cylinders;

25           Fig. 6 is a perspective view of the foot end of the base, showing the foot end cross member, two longitudinally extending siderails coupled to the cross member, a caster assembly coupled to one end of the cross member, a brake-steer butterfly pedal coupled to the brake-steer shaft, a pair of hydraulic pressure release pedals coupled to the foot end of the base, a linkage assembly coupling a head end  
30           pressure release pedal to the brake-steer shaft, and a foot pump pedal coupled to the base and coupled to the hydraulic pumps;

Fig. 7 is a sectional view along the line 7-7 in Fig. 5, and showing the steering wheel support assembly movably coupled to the siderails, and disposed in a raised position spaced apart from the floor;

Fig. 8 is a sectional view similar to Fig. 7, and showing the steering  
5 wheel support assembly in a lowered, floor-engaging position;

Fig. 9 is a perspective view showing a support assembly coupling the head end of the upper deck to the head end hydraulic cylinder, the head end support assembly including two generally rectangular frames nested within each other, the rectangular frames being pivotally coupled to each other near their respective foot  
10 ends by a pair of pivot pins for rotation about a transversely extending axis, and showing two longitudinally extending, laterally spaced guide grooves formed on the underside of the upper deck near the head end adjacent to the two sides of the upper deck for receiving rim portions of a pair of wheels rotatably mounted on said pivot  
15 pins, and further showing a pair of rollers mounted to the underside of the upper deck near the head end adjacent to the two sides of the upper deck by a pair of downwardly projecting brackets for reception in a pair of outwardly opening channels formed in the outer rectangular frame;

Fig. 10 is a sectional view taken along the line 10-10 in Fig. 9 of the head end of the upper deck, and showing the two generally rectangular nested frames,  
20 a roller coupled to the underside of the upper deck and received in an outwardly opening channel formed in the outer rectangular frame, the head end hydraulic cylinder coupled to a cross member of the inner rectangular frame by a nut and bolt assembly;

Fig. 11 is a sectional view of a foot end of the upper deck taken along  
25 the line 11-11 in Fig. 4, a side handle with a portion broken away, a foot end cross member coupled to the foot end hydraulic cylinder by a nut and bolt assembly, an upwardly projecting bracket pivotally coupled to one end of the foot end cross member and supporting a pair of rollers, the rollers being configured for reception in an inwardly opening siderail coupled to the underside of the upper deck near the foot  
30 end adjacent to one side thereof for supporting longitudinal movement of the upper deck within a given range, a longitudinally extending locking rod attached to the underside of the upper deck near the foot end adjacent to said one side, a clamp

supported by the foot end cross member and disposed about the locking rod, the clamp normally securely gripping the locking rod to lock the sliding upper deck at a given longitudinal position, a release bar pivotally mounted to the upper deck and coupled to the clamp for freeing the upper deck when actuated to enable the caregiver  
5 to adjust the longitudinal position of the upper deck;

Fig. 12 is a sectional view of the foot end of the upper deck taken along the line 12-12 in Fig. 11, showing the side handle with portions broken away, two rollers in phantom received in the inwardly opening siderail coupled to the underside of the upper deck near the foot end adjacent to said one side, an upwardly  
10 projecting bracket pivotally coupled to the foot end cross member for supporting the rollers near the foot end of the upper deck, the locking rod fixed to the underside of the upper deck, the clamp disposed about the locking rod, and a cable coupling the release bar to the clamp;

Fig. 13 is a side view similar to Fig. 1, showing in dotted lines the upper deck slid toward the foot end of the stretcher, and further showing in solid lines the C-Arm positioned adjacent to the head of a patient supported on the upper deck and tilted about a transversely extending axis to shoot an image diagonally through the neck, and further showing in phantom lines the C-Arm positioned adjacent to the lower back of the patient and tilted to shoot an image diagonally through the tailbone;  
15

Fig. 14 is an end view of the stretcher, showing the C-Arm rotated about a longitudinally extending axis to shoot an image through the head of a patient supported on the upper deck without interference from siderails or any other metal structures in the imaging region; and  
20

Fig. 15 is a plan view similar to Fig. 4, showing the upper deck formed to include a cutout near the head end to provide space for a patient's face lying in a prone position on the upper deck.  
25

#### Detailed Description of the Drawings

Although the term "stretcher" is used throughout the specification, it is understood that the novel features of the invention may be incorporated into any type of a patient support device - such as a hospital bed or an operating table. Also, although the term "fluoroscopy" is used throughout the specification for convenience,  
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it will be construed to include any other type of imaging. Also the terms "hydraulic pump" or "hydraulic cylinder" or "hydraulic pump/cylinder assembly" will be construed to include any hydraulic, pneumatic, mechanical or electrical device for lifting, lowering or tilting the upper deck. In other words, the features of the present invention are not to be limited to the use with a stretcher or a fluoroscope or a hydraulic device.

Referring to Figs. 1-4, a stretcher 20 in accordance with the present invention includes a low profile base 22 with a relatively large wheelbase, a relatively narrow, slidably mounted upper deck 24 coupled to the base 22, a protective shroud 26 covering the base 22, a head end 32, a foot end 34, an elongated first side 36, an elongated second side 38 and a longitudinal axis 40. As used in this description, the phrase "head end 32" will be used to denote the end of any referred-to object that is positioned to lie nearest the head end 32 of the stretcher 20, and the phrase "foot end 34" will be used to denote the end of any referred-to object that is positioned to lie nearest the foot end 34 of the stretcher 20. Likewise, the phrase "first side 36" will be used to denote the side of any referred-to object that is positioned to lie nearest the first side 36 of the stretcher 20 and the phrase "second side 38" will be used to denote the side of any referred-to object that is positioned to lie nearest the second side 38 of the stretcher 20.

The upper deck 24 is formed from a radiolucent material - end to end and side to side - to facilitate fluoroscopic observations of a patient supported on the upper deck 24 - for example, for conducting pain management procedures. The stretcher 20 is particularly suitable for use in endoscopy, cardiac catheterization, and other procedures requiring fluoroscopy. As shown in Fig. 13, the deck 24 is movable toward the foot end 34 of the stretcher 20 so that a C-Arm 42 can position under the head of a patient supported on the upper deck 24 and tilted about a transversely extending axis to shoot an image diagonally through the neck of the patient without pulling the C-Arm out from under the patient. Relatively narrow upper deck 24 (about 20 inches or 50 centimeters wide) allows the C-Arm 42 to rotate about a longitudinally extending axis from a vertical orientation to a horizontal orientation, as shown in Fig. 14, to shoot an image horizontally through the head of a patient



supported on the upper deck 24 without interference from siderails - particularly non-removable metal siderails.

The base 22 is supported on floor 28 by four caster assemblies 30 to allow the stretcher 20 to be rolled over the floor 28 to transport a patient. The upper  
5 deck 24 is movably supported above the base 22 by a lifting mechanism 50 in order to raise, lower, and tilt the upper deck 24 relative to the base 22. Illustratively, the upper deck lifting mechanism 50 includes head end and foot end hydraulic cylinders 52 and 54 covered by flexible boots 56. The hydraulic cylinders 52, 54 (sometimes referred  
10 to herein as the actuators) are spaced wide apart (about 60 inches or 150 centimeters) to provide room for maneuvering the C-Arm 42. The hydraulic cylinders 52, 54 are coupled to respective hydraulic pumps 62 and 64 supported on the base 22. The head end hydraulic cylinder 52 controls the vertical position of the head end 32 of the upper deck 24 relative to the base 22, and the foot end hydraulic cylinder 54 controls the vertical position of the foot end 34 of the upper deck 24 relative to the base 22. The  
15 hydraulic cylinders 52, 54 adjust the vertical position of the upper deck 24 between a low position (about 24 inches or 60 centimeters above the floor) to facilitate patient egress and ingress, and a high position (about 40 inches or 102 centimeters above the floor) to provide a comfortable position for a Surgeon standing next to a patient supported on the upper deck 24. In addition, the hydraulic cylinders 50, 52 tilt the  
20 upper deck 24 to one of three positions - a flat, horizontal position shown in Fig. 1, a Trendelenburg position shown in Fig. 2 where a patient's feet are raised above the patient's head, or a reverse Trendelenburg position shown in Fig. 3 where the patient's head is raised above the patient's feet.

A mattress pad 70 may be disposed on the upper deck 24 for  
25 supporting a patient as shown in Figs. 1 and 14. The mattress pad 70 may include selectively activated, inflatable bladders to provide special support that may be required for certain medical procedures - such as imaging a patient's spine when the patient is lying in a prone position on the deck 24, for example, for pain management procedures. The upper deck 24 is configured to form a raised, gently curved push  
30 handle 72 near the head end 32 of the stretcher 20, and two downwardly sloping side handles 74 near the foot end 34 adjacent to the two sides 34, 36 of the stretcher 20 as shown in Figs. 1-4. A caregiver can grip either the head end push handle 72 or the

two foot end side handles 74 to maneuver the stretcher 20 over the floor 20. After unlocking the upper deck 24, the caregiver may use the head end push handle 72 or the foot end side handles 74 to move the upper deck 24 to a desired position, and then lock the upper deck 24 in place. As indicated, the caregiver may wish to move the  
5 upper deck 24 to a different position to view a different portion of a patient's body for a diagnostic or a surgical procedure. The ergonomic designs of the handles 72, 74 provide a comfortable grip.

As shown in Figs. 4 and 15, a cutout 76 is formed in the upper deck 24 to provide space for a patient's face lying in a prone position on the upper deck 24. In  
10 accordance with one aspect of the present invention, the stretcher 20 is configured such that the cutout 76 is located between the hydraulic cylinders 52, 54 in an X-ray window 300 when the deck 24 is moved toward the foot end 34 of the stretcher 20 to facilitate shooting an image diagonally through the neck of the patient as shown in Fig. 13. A transversely extending cross bar 84 is secured to the upper deck 24 near  
15 the head end 32 of the stretcher 20. In accordance with another aspect of the present invention, an armboard 78 is pivotally coupled to each end of the cross bar 84 by a pivot pin 78' adjacent to the two sides 34, 36 for movement between a first position extending toward the foot end and a second position extending away from the foot end for supporting a patient's arms. Pivoting armboards 78 allow prone patients to  
20 position their arms over their heads and still be supported by the armboards 78 as shown in Fig. 4. The upper deck 24 is further configured to form openings 80 adjacent to the two sides 34, 36 for removably receiving a pair of plug-in siderails 82 as shown in Fig. 1. The removable siderails 82 allow shooting an image diagonally through the head or the tailbone of a patient supported on the upper deck 24 without  
25 interference from the siderails 82 as shown in Fig. 14. One or more IV poles may be secured to the cross bar 84 near the head end 32 of the stretcher 20 for holding solution containers or other objects at a position elevated above the upper deck 24. The foot end portion 88 of the upper deck 24 may be angled away from the upper deck 24 to provide comfortable ankle support for a patient lying in a prone position on  
30 the upper deck 24. Illustratively, the upper deck 24 is molded from a radiolucent foam plastic material and provided with fiber glass outer shell. The handles 72, 74,

the cutout 76 and the siderail openings 80 may all be integrally molded with the upper deck 24.

The combination of a relatively narrow deck (about 20 inches or 50 centimeters), a high position of the deck 24 when raised to a full height (about 40 inches or 102 centimeters above the floor) and widely spaced-apart hydraulic cylinders 52, 54 (about 60 inches or 150 centimeters) can cause instability. Stability is very important during these types of procedures, and the litter 24 must not wobble. Also, the litter 24 must be stable for a patient to get on and off. Typically, OR tables (Operating Room tables) have a very heavy base to add stability. A heavy base is not acceptable on fluoroscopic-type stretchers that have some intention of being transportable. A wide wheelbase (about 24 inches or 60 centimeters) is therefore desired for stability along with a narrow top (about 20 inches or 50 centimeters) to allow rotation of the C-arm 42 about a longitudinally extending axis as shown in Fig 14. However, the caster assemblies 30 or the brake-steer pedals 114 cannot protrude farther out than the upper deck 24 as it creates a trip hazard if walking around the stretcher 20. In accordance with an aspect of the present invention, the side handles 74 and the armboards 78 extend outwardly from the deck 24 beyond the caster assemblies 30 and the brake-steer pedals 114 coupled to the base 22. Thus, the caster assemblies 30 and the brake-steer pedals 114 remain within the footprint of the upper deck 24, the side handles 74 and the armboards 78.

As shown in Fig. 5, the base 22 includes a head end cross member 92 and a foot end cross member 94. The head end and foot end cross members 92, 94 are held in longitudinally spaced apart relationship by two longitudinally extending, laterally spaced siderails 96 and 98 secured to downwardly extending brackets (not shown) fixed to the cross members 92, 94. The two longitudinally extending siderails 96, 98 have step-down middle portions 100 that are configured to be closer to the floor 28 (about 4 inches or 10 centimeters from the floor 28) than their respective end portions (about 13 inches or 33 centimeters from the floor 28). The step-down middle portions 100 of the base 22 provides more vertical clearance between the base 22 and the upper deck 24 between the two hydraulic cylinders 52, 54 in the central imaging region 300 for the C-Arm 42. High end portions of the base 22, on the other hand, allow use of larger caster assemblies 30. A short end section 102 is attached at each

end of the two siderails 96, 98 to lend rigidity to the structure. Coupled to each end of the two cross members 92, 94 is an outwardly extending right angle bracket 104. Each right angle bracket 104 supports a caster assembly 30 and a brake-steer butterfly pedal 114. A cross plate 106 is attached to the two siderails 96, 98 near the head end 32 of the base 22 to support the head end hydraulic cylinder/pump assembly 52/62. Likewise, another cross plate 106 is attached to the two siderails 96, 98 near the foot end 34 of the base 22 to support the foot end hydraulic cylinder/pump assembly 54/64. The cross members 92, 94, the siderails 96, 98 and short end sections 102 are in the form of extruded tubes having a square cross section, and made from rigid, high-strength, light-weight materials, such as steel or aluminum.

A longitudinally extending brake-steer shaft 108 is slidably and rotatably mounted to the siderail 98 near the second side 38 of the base 22 by a plurality of brackets 110 as shown in Fig. 5. The brake-steer shaft 108 rotates about its longitudinal axis 112 in either direction in response to rotation of a brake-steer butterfly pedal 114, and is translatable in a longitudinal direction, indicated by a double-headed arrow 116, either toward or away from the foot end 34 in response to the operation of a head end pressure release pedal 182 coupled to the foot end 34 of the base 22. A linkage assembly 122 couples the brake-steer shaft 108 to two brake-steer pedals 114 at the head end 32 of the stretcher 20. Likewise, a linkage assembly 124 couples the brake-steer shaft 108 to two brake-steer pedals 114 at the foot end 34 of the stretcher 20. Since the two linkage assemblies 122, 124 are similar to each other, only the foot end linkage assembly 124 will be described.

Referring to Fig. 6, the foot end linkage assembly 124 includes a cross shaft 126 having its ends rotatably supported by two outwardly extending right angle brackets 104 coupled to the foot end cross member 94. Another bracket 128, having a C-configuration in plan view, supports the cross shaft 126 intermediate of the two right angle brackets 104. The bracket 128 includes two vertically disposed side plates 128' held in laterally spaced apart relation by a crosswise back plate 128". The back plate 128" is fixed to the foot end cross member 94. A brake-steer pedal 114 is fixed to each end of the cross shaft 126. A bent link 130 has a first end 130' fixed to the cross shaft 126 between the two vertically extending side plates 128' of the bracket 128, and a second end 130" pivotally coupled to a first end 132' of a connecting link

132. The second end 132" of the connecting link 132 is pivotally coupled to a first end 134' of a short link 134. A second end 134" of the short link 134 is fixed to the foot end 34 of the brake-steer shaft 108.

The brake-steer pedal 114 has three positions: (a) a generally horizontal neutral position, (aa) a braking position where a braking portion 136 of the brake-steer pedal 114 is angled downwardly and an opposite steering portion 138 of the brake-steer pedal 114 is angled upwardly, and (aaa) a steering position where the steering portion 138 of the brake-steer pedal 114 is angled downwardly and the braking portion 136 of the brake-steer pedal 114 is angled upwardly. When the brake-steer pedal 114 is generally horizontal, the caster assemblies 30 are free to swivel and rotate. From the generally horizontal neutral position, the caregiver can depress the braking portion 136 of the brake-steer pedal 114 in an anticlockwise braking direction indicated by arrow 140 in Fig. 6 to a braking position. Rotation of the brake-steer pedal 114 to the braking position moves brake shoes (not shown) into engagement with the caster assemblies 30 to lock the caster assemblies 30 in place.

From the braking position, the caregiver can depress the steering portion 138 of the brake-steer pedal 114 to rotate the brake-steer pedal 114 back to the horizontal neutral position. When the brake-steer pedal 114 is in the neutral position, the caregiver can depress the steering portion 138 of the brake-steer pedal 114 to rotate the cross shaft 126 in a clockwise steering direction indicated by arrow 142 in Fig. 6 to a steering position. Rotation of the cross shaft 126 to the steering position, causes the bent link 130 to also rotate in the clockwise direction 142 to, in turn, cause the connecting link 132 to move in a downwardly direction indicated by arrow 144 and cause the short link 134 and the brake-steer shaft 108 to rotate in an anticlockwise direction indicated by arrow 146 in Fig. 6. Rotation of the brake-steer shaft 108 in the anticlockwise direction 146 causes a steering wheel support assembly 150 to lower a pair of steering wheels 152 to engage the floor 28.

As shown in Figs. 5, 7 and 8, the steering wheel support assembly 150 includes a shaft 154 having the wheels 152 (also referred to herein as center or steering wheels) mounted side-by-side thereon. The shaft 154 is fixed to the foot end 34 of an elongated wheel-mounting bracket 156. The head end 32 of the wheel-mounting bracket 156 is pivotally coupled to a cross plate 158 having its ends attached

to the siderails 96, 98. The wheel-mounting bracket 156 is movable between a raised position shown in Fig. 7 where the steering wheels 152 are spaced apart from the floor 28, and a lowered position shown in Fig. 8 where the steering wheels 152 are in engagement with the floor 28. A vertically extending spring 160 extends between the foot end 34 of the wheel-mounting bracket 156 and the siderail 96. The vertically  
5 extending spring 160 normally biases the wheel-mounting bracket 156 to the raised position spaced apart from the floor 28. Fixed to the wheel-mounting bracket 156 is a transversely extending cam plate 162 having a downwardly sloping end portion 164 extending toward the brake-steer shaft 108. The downwardly sloping end portion 164  
10 of the cam plate 162 is configured for engagement with a cam 166 mounted on the brake-steer shaft 108. As explained above, rotation of the steer portion 138 of the brake-steer pedal 114 in the clockwise direction 142 to the steering position causes the brake-steer shaft 108 to rotate in the anticlockwise direction 146 shown in Fig. 6. Rotation of the brake-steer shaft 108 in the anticlockwise direction 146 causes the  
15 cam 166 fixed thereto to also rotate in an anticlockwise direction indicated by arrow 168 in Fig. 7. Rotation of the cam 164 to in the anticlockwise direction 168 displaces the wheel-mounting bracket 156 in a downward direction indicated by arrow 170, causing the steering wheels 152 to engage the floor 28 as shown in Fig. 8.

The upper deck lifting mechanism 50 includes a foot pump pedal 180,  
20 a head end pressure release pedal 182 and a foot end pressure release pedal 184 as shown in Fig. 6. The pedals 180-184 are pivotally coupled to the base 22 near the foot end 34 of the stretcher 20, and control the vertical movement of the head end 32 and the foot end 34 of the upper deck 24. From their generally horizontal operative positions shown in Fig. 6, the pressure release pedals 182, 184 can be flipped up to  
25 their respective, generally vertical out-of-the-way inoperative positions.

Referring to Figs. 1-3, 5 and 6, an actuating member 186 includes an outwardly extending, generally horizontal portion 188, an intermediate base portion 190 and a downwardly extending, generally vertical portion 192. The foot pump pedal 180 is fixed to the free end of the generally horizontal, outwardly extending  
30 portion 188. As shown in Fig. 5, the base portion 190 of the actuating member 186 is attached to a cross shaft 194 rotatably coupled to the siderails 96, 98 near the foot end 34 of the stretcher 20. As shown in Figs. 1-3, the free end of the generally vertical

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portion 192 of the actuating member 186 is coupled to the foot end 34 of a longitudinally extending, reciprocally mounted shaft 198 through a right angle member 196 such that vertical reciprocating motion of the foot pump pedal 180 causes horizontal reciprocating motion of the shaft 198. The longitudinally extending shaft 198 is slidably mounted to the siderail 96 near the first side 36 of the stretcher 20 (on the side opposite from the longitudinally extending brake-steer shaft 108) by a plurality of brackets 200 for movement toward and away from the foot end 34 of the stretcher 20 in a direction indicated by a double-headed arrow 202 in Fig. 5. The longitudinally extending shaft 198 is coupled to the head end hydraulic pump 62 near the head end 32 of the stretcher 20 (Figs. 1-3), and to the foot end hydraulic pump 64 near the foot end 34 of the stretcher 20. As shown in Figs. 1-3 and 6, a generally horizontally extending spring 204 is coupled between the free end of the generally vertical portion 192 and the foot end 34 of the siderail 96 to bias the foot pump pedal 180 upwardly to a generally horizontal raised position shown in Fig. 6. From the generally horizontal raised position, the caregiver can depress the foot pump pedal 180 to cause the longitudinally extending shaft 198 to move toward the foot end 34 of the stretcher 20. The caregiver can then release the pressure on the foot pump pedal 180 to allow the generally horizontally extending spring 204 to pull the longitudinally extending shaft 198 away from the foot end 34 of the stretcher 20, and to lift the foot pump pedal 180 upwardly to the generally horizontal raised position shown in Fig. 6. The caregiver can then again depress the foot pump pedal 180. Reciprocating motion of the shaft 198 causes the pumps 62, 64 to pump fluid into the hydraulic cylinders 52, 54 respectively to, in turn, cause the upper deck 24 to rise.

As shown in Fig. 6, an actuating member 210 includes an outwardly extending, generally horizontal portion 212, an intermediate base portion 214 and a downwardly extending, generally vertical portion 216. The head end pressure release pedal 182 is coupled to the free end of the generally horizontal portion 212. The base portion 214 of the actuating member 210 is pivotally coupled to a C-shaped bracket 218 mounted to the foot end 34 of the siderail 98 near the second side 38 of the stretcher 20. The free end of the downwardly extending portion 216 is configured to engage a transverse plate 220 fixed on the brake-steer shaft 108 near the foot end 34 thereof. From a generally horizontal position shown in Fig. 6, the caregiver can

depress the head end pressure release pedal 182 to thereby cause the downwardly extending portion 216 of the actuating member 210 to rotate in a clockwise direction indicated by arrow 222. Rotation of the generally vertical portion 216 in the clockwise direction 222 pushes the transverse plate 220 and the brake-steer shaft 108 coupled thereto toward the head end 32 of the stretcher 20. When the brake-steer shaft 108 moves toward the head end 32, a transversely mounted actuator 224 coupled to the brake-steer shaft 108 depresses a pressure release pin or button 226 coupled to the head end hydraulic pump 62 as shown in Fig. 5 to release the pressure in the head end hydraulic cylinder 52 to, in turn, lower the head end 32 of the upper deck 24. As shown in Fig. 5, a generally horizontally extending spring 228 coupled between the brake-steer shaft 108 and the siderail 98 biases the brake-steer shaft 108 to return to its original position when the pressure release pedal 182 is freed.

An actuating member 240 includes an outwardly extending, generally horizontal portion 242, an intermediate base portion 244 and a downwardly extending, generally vertical portion 246. The foot end pressure release pedal 184 is coupled to the free end of the generally horizontal portion 242. The base portion 244 of the actuating member 240 is pivotally coupled to a C-shaped bracket 248 mounted to the foot end 34 of the siderail 98 near the second side 38 of the stretcher 20. When the foot end pressure release pedal 184 is depressed, the free end of the downwardly extending portion 246 depresses a pressure release pin or button coupled to the foot end hydraulic pump 64 to release the pressure in the foot end hydraulic cylinder 54 to, in turn, lower the foot end 34 of the upper deck 24.

Referring to Figs 9-12, the head end 32 of the radiolucent upper deck 24 is coupled to the head end hydraulic cylinder 52 by a head end support assembly 302, and the foot end 34 of the deck 24 is coupled to the foot end hydraulic cylinder 54 by a foot end support assembly 304. As previously explained, the head end cylinder 52 controls a vertical position of the head end 32 of the upper deck 24, and the foot end cylinder 54 controls a vertical position of the foot end 34 of the upper deck 24. As shown in Figs. 1-3, the head end and foot end support assemblies 302, 304 are spaced wide apart (about 60 inches or 150 centimeters) to define the central imaging region 300 above the base 22 between the head end and foot end hydraulic cylinders 52, 54 which is free of any metallic structures that would interfere with



imaging. The two support assemblies 302, 304 (sometimes referred to herein as the head end and foot end connectors) secure the upper deck 24 to the base 22, while allowing translation of the upper deck 24 toward the foot end 34 of the stretcher 20 so that a C-Arm 42 can be positioned anyplace from the neck to the tailbone of a patient supported on the deck 24 or tilted to a suitable angle as shown in Fig. 13, or rotated from a vertical to a horizontal orientation as shown in Fig. 14 without any obstruction and without having to pull the C-Arm out from under the patient. For example, the C-Arm 42 can be located near the head end 32 of the stretcher 20 and tilted as shown in Fig. 13 to shoot an image diagonally through the neck of the patient.

As shown in Figs. 9 and 10, the head end support assembly 302 includes a generally rectangular inner frame 312 nested inside a generally rectangular outer frame 314. The inner and outer frames 312, 314 are pivotally coupled to each other near their respective foot ends 34 for rotation about a first transversely extending axis 316. The inner frame 312 includes first and second longitudinally extending siderails 322, 324 in the form of inwardly opening channels. The longitudinally extending siderails 322, 324 are held in laterally spaced apart relationship by a head end cross member 332 in the form of a circular tube and a foot end cross member 334 in the form of a square tube. The head end cross member 332 is rigidly attached to the head end hydraulic cylinder 52 by a nut and bolt assembly 336. The outer frame 314, on the other hand, includes first and second longitudinally extending siderails 342, 344 in the form of outwardly opening channels. The longitudinally extending siderails 342 and 344 are held in laterally spaced-apart relationship by a head end cross member 352 in the form of a square tube and a foot end cross member 354 in the form of a rectangular plate mounted on the top side of the outer frame 314. The foot ends 34 of the inner siderails 322, 324 and the foot ends 34 of the outer siderails 342, 344 are pivotally coupled to each other by pivot pins 358 for rotation about the transversely extending axis 316. Pivotal coupling of the inner and outer frames 312, 314 allows the upper deck 24 to pivot to a Trendelenburg position shown in Fig. 2 or to a reverse Trendelenburg position shown in Fig. 3.

The underside of the upper deck 24 is formed to include two longitudinally extending, laterally spaced guide grooves 362 for receiving rim

portions of wheels 372 freely rotatable on the pivot pins 358. The wheels 372 are located between the outer walls of the inner siderails 322, 324 and the inner walls of the outer siderails 342, 344 adjacent to the foot ends 34 of the inner and outer frames 312, 314. The outwardly opening channels 342, 344 of the outer frame 314 are  
5 configured to receive a pair of rollers 382 mounted to the underside of the upper deck 24 for rotation about a second transversely extending axis 386 by a pair of downwardly projecting brackets 392. As shown in Fig. 10, a pair of guard members 402 in the form of inwardly opening channels are coupled to the outwardly opening channels 342, 344 by plate members 412 mounted on the bottom side thereof to form  
10 enclosed tracks 416 for receiving the rollers 382 mounted to the underside of the upper deck 24. The outwardly facing top edges 418 of the outer channel members 342, 344 and the inwardly facing top edges 420 of the guard members 402 form longitudinally extending channels or slots 422 along the two sides of the upper deck 24 for slidably receiving the roller-supporting brackets 392. The reception of the  
15 rollers 382 mounted to the underside of the upper deck 24 in the enclosed tracks 416 secures the head end 32 of the upper deck 24 to the base 22, while allowing the upper deck 24 to translate longitudinally relative to the base 22 within a certain limited range.

Referring to Figs. 11 and 12, the foot end support assembly 304  
20 includes a cross member 424 in the form of a circular tube rigidly attached to the foot end hydraulic cylinder 54 by a nut and bolt assembly 426. An upwardly projecting bracket 432 is pivotally attached to the each end of the tubular cross member 424 for rotation about a third transversely extending axis 436. Pivotal movement of the brackets 432 relative to the foot end cross member 424 allows the upper deck 24 to  
25 pivot to a Trendelenburg position shown in Fig. 2 or to a reverse Trendelenburg position shown in Fig. 3. Each of the brackets 432 supports a pair of rollers 442 configured for reception in the first and second longitudinally extending, inwardly opening channels 452 mounted to the underside of the upper deck 24 adjacent to the foot end 34 thereof. Reception of the rollers 442 mounted to the cross member 424 in  
30 the inwardly opening channels 452 mounted to the underside of the upper deck 24 holds the foot end 34 of the upper deck 24 in place, while allowing the upper deck 24 to translate longitudinally within a predetermined range relative to the base 22.

When the upper deck 24 is horizontal as shown in Fig. 1, a patient's weight is transferred to the rollers 382 near the head end 32 of the stretcher 20, and to the rollers 442 near the foot end 34 of the stretcher 20. The patient's weight on the rollers 382 near the head end 32 of the stretcher 20 is transferred to the outer siderails 342, 344 (urging the outer siderails 342, 344 to rotate about the transversely extending axis 316 in a clockwise direction 456 shown in Fig. 9), then to the inner frame 312 through the top cross plate 354, and finally to the head end hydraulic cylinder 52 through the head end cross member 332. On the other hand, the patient's weight on the rollers 442 near the foot end 34 of the stretcher 20 is transferred to the foot end cross member 424 through the pivotally mounted brackets 432, and then to the foot end hydraulic cylinder 54 through the foot end cross member 424.

To move the upper deck 24 to the Trendelenburg position shown in Fig. 2 from the horizontal position shown in Fig. 1, hydraulic pressure in the head end hydraulic cylinder 52 is released by using the head end pressure release pedal 182 coupled to the foot end 34 of the stretcher 20, causing the head end cross member 332 to move down. When the head end cross member 332 moves down, both the inner and outer frames 312 and 314 move down, and the upper deck 24 pivots about the axis 386 of the rollers 382 near the head end 32 of the stretcher 20 and the axis 436 of the pivotally mounted brackets 432 near the foot end 34 of the stretcher 20. In the Trendelenburg position, a patient's weight is transferred to the rollers 382 near the head end 32 of the stretcher 20, and to the rollers 442 near the foot end 34 of the stretcher 20. The patient's weight on the rollers 382 near the head end 32 of the stretcher 20 is transferred to the outer siderails 342 (urging the outer siderails 342, 344 to rotate about the transversely extending axis 316 in a clockwise direction 458 in Fig. 2), then to the inner frame 312 through the top cross plate 354, and finally to the head end hydraulic cylinder 52 through the head end cross member 332. On the other hand, the patient's weight on the rollers 442 near the foot end 34 of the stretcher 20 is transferred to the foot end cross member 424 through the pivotally mounted brackets 432, and to the foot end hydraulic cylinder 54 through the foot end cross member 424.

To move the upper deck 24 to the reverse Trendelenburg position shown in Fig. 3 from the horizontal position shown in Fig. 1, hydraulic pressure in the foot end hydraulic cylinder 54 is released by using the foot end pressure release pedal

184 coupled to the foot end 34 of the stretcher 20 to cause the foot end cross member 424 to move down. When the foot end cross member 422 moves down, the outer frame 314 pivots about the axis 316 of the wheels 372 near the head end 32 of the stretcher 20 in the direction 460 in Fig. 3. The upper deck 24, on the other hand, pivots about the axis 316 of the wheels 72 near the head end 32 of the stretcher 20, and about the axis 436 of the pivotally mounted brackets 432 near the foot end 34 of the stretcher 20. In the reverse Trendelenburg position, a patient's weight is transferred to the wheels 372 near the head end 32 of the stretcher 20, and to the rollers 442 near the foot end 34 of the stretcher 20. The patient's weight on the wheels 372 near the head end 32 of the stretcher 20 is transferred to the inner frame 312 through the pivot pins 358, and then to the head end hydraulic cylinder 52 through the head end cross member 332. On the other hand, the patient's weight on the rollers 442 near the foot end 34 of the stretcher 20 is transferred to the foot end cross member 424 through the pivotally mounted brackets 432, and then to the foot end hydraulic cylinder 54 through the foot end cross member 424.

Thus, the novel configuration of the head end and foot end support assemblies 302 and 304 allows the upper deck 24 to move toward the foot end 34 of the stretcher 20, so that a C-Arm 42 can be positioned anywhere from the neck to the tailbone of a patient supported on the deck 24, or tilted about a transversely extending axis as shown in Fig. 13, or rotated about a longitudinally extending axis as shown in Fig. 14 without any obstruction and without the necessity of pulling the C-Arm out from under the patient. The support assemblies 302, 304 also allow the entire upper deck 24 to be raised or lowered as shown in Fig. 1, move the upper deck 24 to a Trendelenburg position as shown in Fig. 2 or to a reverse Trendelenburg position as shown in Fig. 3.

An upper deck locking mechanism 470 is provided for selectively locking the upper deck 24 at a given longitudinal position with respect to the base 22 as shown in Figs. 11 and 12. The upper deck locking mechanism 470 includes a longitudinally extending locking rod 472 attached to the underside of the foot end 34 of the upper deck 24 near the first side 36 of the stretcher 20 by means of a pair of downwardly projecting brackets 474. A clamp 476 is disposed about the rod 472, and is secured to the foot end cross member 424 by a bracket 478. The clamp 476 is

normally biased to tightly grip the rod 472 to lock the upper deck 24 in place. An upper deck release bar 480 is pivotally mounted to the siderail 452 adjacent to the foot end side handle 64 near the first side 36 of the stretcher 20. The release bar 480 is normally biased in a direction away from the side handle 64. A cable 482 has one end 5 484 secured to the release bar 480 and a second end 486 secured to the clamp 476. To free the upper deck 60, the release bar 480 is lifted toward the side handle 64. When the release bar 480 is lifted, the end 484 of the cable 482 attached to the release bar 480 is pulled. When the end 484 of the cable 482 is pulled, the second end 486 of the cable 482 secured to the clamp 476 pulls on the clamp 476 to open it up to release the 10 locking rod 472 to, in turn, free the upper deck 24 to move longitudinally relative to the base 22.

Although the invention has been described in detail with reference to a certain preferred embodiment, variations and modifications exist within the scope and spirit of the invention as described and as defined in the following claims.

CLAIMS:

1. A patient support apparatus comprising:  
an elongated base having first and second ends,  
5 a plurality of casters rotatably mounted to the base, and engaging a  
floor,  
an upper deck,  
first and second actuators coupled to the base adjacent to the first and  
second ends thereof respectively for movably supporting the upper deck between a  
10 low position and a high position, the first actuator controlling a vertical position of a  
first end of the upper deck and the second actuator controlling a vertical position of a  
second end of the upper deck,  
an elongated shaft having a longitudinal axis, the shaft being coupled  
to the base for rotation about the longitudinal axis between a first orientation and a  
15 second orientation, and for movement along the longitudinal axis,  
a wheel coupled to the shaft for movement relative to the base between  
a first position spaced apart from the floor when the shaft is rotated to the first  
orientation, and a second position engaging the floor when the shaft is rotated to the  
second orientation, and  
20 a foot pedal movably mounted to the base adjacent to the second end  
thereof, the foot pedal being configured to engage a portion of the shaft adjacent to  
the second end of the base to move the shaft toward the first end and cause the first  
actuator to adjust the vertical position of the first end of the upper deck.
2. The apparatus of claim 1, wherein the first and second ends of  
25 the base correspond to a head end and a foot end thereof, wherein the first and second  
actuators correspond to a head end actuator and a foot end actuator, and wherein the  
foot pedal is movably mounted to the base adjacent to the foot end thereof, and is  
configured to engage said portion of the shaft adjacent to the foot end to move the  
shaft toward the head end and cause the head end actuator to lower the head end of the  
30 upper deck.
3. The apparatus of claim 2, wherein actuators are hydraulic  
cylinders, wherein the apparatus further includes a foot pump pedal movably mounted

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to the base adjacent to the foot end thereof, and coupled to the hydraulic cylinders for pumping fluid into the respective hydraulic cylinders for raising the upper deck relative to the base.

4. The apparatus of claim 3, wherein the head end hydraulic  
5 cylinder includes a pressure release button, and wherein a portion of the shaft adjacent to the head end of the base is configured to engage said pressure release button when the shaft is moved toward the head end, and release hydraulic pressure in the head end hydraulic cylinder to lower the head end of the upper deck.

5. The apparatus of claim 4, further including a first linkage  
10 assembly for selectively coupling the foot pedal to said portion of the shaft adjacent to the foot end.

6. The apparatus of claim 5, wherein the first linkage assembly  
includes an actuating member having an outwardly extending, generally horizontal  
15 portion, an intermediate base portion and a downwardly extending, generally vertical portion, wherein the foot pedal is coupled to the free end of the generally horizontal portion, wherein the base portion of the actuating member is pivotally coupled to the foot end of the base, wherein actuation of the foot pedal causes rotation of the  
downwardly extending portion of the actuating member, wherein the free end of the  
20 downwardly extending portion is configured to engage said portion of the shaft near the foot end thereof and cause translation of the shaft toward the head end, and wherein translation of the shaft toward the head end causes actuation of the pressure release button to release the pressure in the head end hydraulic cylinder to, in turn, lower the head end of the upper deck.

7. The apparatus of claim 5, wherein the first linkage assembly  
25 further includes a transverse plate attached to the shaft adjacent to the foot end, wherein the free end of the downwardly extending portion is configured to engage said transverse plate and cause translation of the transverse plate and the shaft attached thereto toward the head end, and wherein translation of the shaft toward the head end causes actuation of the pressure release button to release the pressure in the  
30 head end hydraulic cylinder to, in turn, lower the head end of the upper deck.

8. The apparatus of claim 7, wherein the first linkage assembly further includes a spring coupled to the shaft to bias the shaft to return to its original position when the foot pedal is released.

9. The apparatus of claim 4, further including a second foot pedal  
5 movably mounted to the base adjacent to the foot end thereof, wherein the foot end hydraulic cylinder includes a pressure release button, wherein the second foot pedal is configured to engage the pressure release button coupled to the foot end hydraulic cylinder and release hydraulic pressure in the foot end hydraulic cylinder to lower the foot end of the upper deck.

10. The apparatus of claim 1, further including a brake-steer pedal  
10 mounted to the base near the foot end thereof for movement between a brake position and a steer position, and a foot end linkage assembly for coupling the brake-steer pedal to the shaft such that the shaft is moved to the first orientation and the wheel is spaced apart from the floor when the brake-steer pedal is moved to the brake position,  
15 and the shaft is moved to the second orientation and the wheel is engaging the floor when the brake-steer pedal is moved to the steer position.

11. The apparatus of claim 10, wherein the shaft has a third neutral position intermediate of the brake and steer positions thereof.

12. The apparatus of claim 10, wherein the foot end linkage  
20 assembly includes a cross shaft rotatably coupled to the foot end of the base, the cross shaft supporting a brake-steer pedal adjacent to each end thereof, the foot end linkage assembly further including a bent link fixed to the cross shaft, a connecting link having one end pivotally coupled to the bent link and a second end pivotally coupled to a short link fixed to the foot end of the shaft, wherein rotation of the brake-steer  
25 pedal to the brake position causes the shaft to rotate to the first orientation and lift the wheel off the floor, and wherein rotation of the brake-steer pedal to the steer position causes the shaft to rotate to the second orientation and lower the wheel to engage the floor.

13. The apparatus of claim 1, further including a steering wheel  
30 support assembly to couple the shaft to the wheel, wherein the steering wheel support assembly includes a bracket supporting the wheel and pivotally coupled to the base for movement between a first position where the wheel is spaced apart from the floor



and a second position where the wheel is engaging the floor, a spring biasing the bracket to the first position where the wheel is spaced apart from the floor, and a cam fixed to the shaft and configured to engage the bracket to cause movement of the bracket to the second position where the wheel is engaging the floor when the shaft is  
5 rotated to the second orientation.

14. A patient support apparatus comprising:  
an elongated base having first and second ends,  
an upper deck,  
first and second actuators coupled to the base adjacent to the first and  
10 second ends respectively for movably supporting the upper deck between a low position and a high position, the first actuator controlling a vertical position of a first end of the upper deck and the second actuator controlling a vertical position of a second end of the upper deck,

an elongated shaft having a longitudinal axis, the shaft being coupled  
15 to the base for movement along the longitudinal axis, and  
a foot pedal movably mounted to the base adjacent to the second end thereof, the foot pedal being configured to engage a portion of the shaft adjacent to the second end of the base to move the shaft toward the first end and cause the first actuator to adjust the vertical position of the first end of the upper deck.

15. The apparatus of claim 14, wherein the shaft is coupled to the base for rotation about the longitudinal axis between a first orientation and a second orientation, wherein the apparatus further includes a plurality of casters rotatably mounted to the base and engaging a floor, and a wheel coupled to the shaft for movement relative to the base between a first position spaced apart from the floor  
25 when the shaft is rotated to the first orientation, and a second position engaging the floor when the shaft is rotated to the second orientation.

16. The apparatus of claim 15, further including a steering wheel support assembly to couple the shaft to the wheel, wherein the steering wheel support assembly includes a bracket supporting the wheel and pivotally coupled to the base  
30 for movement between a first position where the wheel is spaced apart from the floor and a second position where the wheel is engaging the floor, a spring biasing the bracket to the first position where the wheel is spaced apart from the floor, and a cam

fixed to the shaft and configured to engage the bracket to cause movement of the bracket to the second position where the wheel is engaging the floor when the shaft is rotated to the second orientation.

17. A patient support apparatus comprising:
- 5 an elongated base having a head end and a foot end,  
a radiolucent upper deck having a head end and a foot end,  
head end and foot end actuators coupled to the base adjacent to the  
head and foot ends respectively,  
a head end connector for coupling the head end of the upper deck to  
10 the head end actuator, the head end actuator controlling a vertical position of the head  
end of the upper deck,  
a foot end connector for coupling the foot end of the upper deck to the  
foot end actuator, the foot end actuator controlling a vertical position of the foot end  
of the upper deck, and  
15 the head end and foot end connectors being spaced apart to define a  
central imaging region above the base between the head end and foot end actuators  
which is free of any structure that would interfere with imaging of a patient supported  
on the upper deck.

18. The apparatus of claim 17, wherein the head end and foot end  
20 connectors secure the upper deck to the base while allowing (a) translation of the  
upper deck toward the foot end of the base, (aa) movement of the upper deck between  
a low position and a high position, and (aaa) rotation of the upper deck between a first  
position where the foot end of the upper deck is raised above the head end thereof and  
a second position where the head end of the upper deck is raised above the foot end  
25 thereof.

19. The apparatus of claim 18, wherein translation of the upper  
deck toward the foot end of the base locates the head of a patient supported on the  
deck in the central imaging region.

20. The apparatus of claim 17, further including a plurality of  
30 casters rotatably mounted to the base, and engaging a floor.

21. The apparatus of claim 20, wherein a portion of the base  
extending between the head end and foot end actuators is formed to be closer to a

floor than the end sections thereof to provide more clearance between the upper deck and the base between the actuators.

22. The apparatus of claim 21, wherein the base includes head end and foot end cross members held in longitudinally spaced apart relation by a pair of longitudinally extending, laterally spaced siderails, wherein a caster is coupled to each end of the two cross members, and wherein the longitudinally extending siderails are formed to include step-down middle portions extending between the head end and foot end actuators that are configured to be closer to the floor than the cross members supporting the casters to provide more clearance between the upper deck and the base between the actuators.

23. The apparatus of claim 17, wherein the upper deck is formed to include a cutout adjacent to the head end thereof to provide space for a patient's face lying in a prone position on the upper deck.

24. The apparatus of claim 23, wherein the upper deck is molded from a plastic material, and wherein the cutout is integrally molded therewith.

25. The apparatus of claim 17, wherein the upper deck is formed to include an opening adjacent to a first side thereof for supporting a removable siderail.

26. The apparatus of claim 25, wherein the siderail includes a cantilevered portion and a leg portion, wherein the leg portion is received in said opening in the upper deck to removably secure the siderail to the upper deck.

27. The apparatus of claim 17, wherein the upper deck is formed to include a pair of openings adjacent to first and second sides thereof for supporting a pair of removable siderails.

28. The apparatus of claim 27, wherein the upper deck is molded from a plastic material, and wherein the openings for the siderails are integrally molded with the upper deck.

29. The apparatus of claim 17, wherein the upper deck is formed to include a plurality of handles integrally therewith which are also made of radiolucent material.

30. The apparatus of claim 29, wherein the upper deck is molded from a plastic material, and wherein the radiolucent handles are integrally molded therewith.

31. The apparatus of claim 29, wherein the upper deck is formed to include a push handle adjacent to the head end of the upper deck, and a pair of side handles adjacent to the two sides of the upper deck near the foot end thereof.

5 32. The apparatus of claim 17, wherein the central imaging region is free of any non-radiolucent components.

33. A patient support apparatus comprising:  
an elongated base having first and second ends,  
an upper deck having first and second ends,  
first and second actuators coupled to the base adjacent to the first and  
10 second ends respectively,  
a first connector for coupling the first end of the upper deck to the first actuator, the first actuator controlling a vertical position of the first end of the upper deck, the first connector including first and second members, the first member being secured to the first actuator, the first and second members being pivotally coupled to  
15 each other adjacent to their ends nearest the second end of the base for rotation about a first transversely extending axis, and the upper deck being translatably and pivotally coupled to the second member by at least one coupler for translation of the upper deck toward the second end of the base and for rotation of the upper deck about a second transversely extending axis which is spaced from the first transversely extending axis  
20 toward the first end of the upper deck, and  
a second connector for coupling the second end of the upper deck to the second actuator, the second actuator controlling a vertical position of the second end of the upper deck.

34. The apparatus of claim 33, wherein pivotal coupling between  
25 the first and second members allows rotation of the upper deck about the first transversely extending axis when the first end of the upper deck is raised above the second end thereof, and wherein pivotal coupling between the upper deck and the second member allows rotation of the upper deck about the second transversely extending axis when the second end of the upper deck is raised above the first end  
30 thereof.

35. A patient support apparatus comprising:  
an elongated base having a head end and a foot end,

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an upper deck having a head end and a foot end,  
head end and foot end actuators coupled to the base adjacent to the  
head and foot ends respectively,

a head end connector for coupling the head end of the upper deck to  
5 the head end actuator, the head end actuator controlling a vertical position of the head  
end of the upper deck, the head end connector including first and second frames, the  
first frame being secured to the head end actuator, the first and second frames being  
pivotally coupled to each other adjacent to their respective foot ends for rotation about  
a first transversely extending axis, and the upper deck being translatably and pivotally  
10 coupled to the second frame by at least one coupler for translation of the upper deck  
toward the foot end of the base and for rotation of the upper deck about a second  
transversely extending axis which is spaced from the first transversely extending axis  
toward the head end of the upper deck, and

a foot end connector for coupling the foot end of the upper deck to the  
15 foot end actuator, the foot end actuator controlling a vertical position of the foot end  
of the upper deck.

36. The apparatus of claim 35, wherein the first and second frames  
correspond to inner and outer frames respectively, and wherein the inner and outer  
frames are configured to be generally rectangular with the inner frame nested inside  
20 the outer frame.

37. The apparatus of claim 36, wherein the underside of the upper  
deck is formed to include a longitudinally extending guide groove for receiving a rim  
portion of a wheel rotatably mounted on a pivot pin near the foot end of the inner and  
outer frames for rotation about the first transversely extending axis.

25 38. The apparatus of claim 36, wherein the outer frame is  
configured to form a longitudinally extending channel for receiving a roller mounted  
to the underside of the upper deck adjacent to the head end of the upper deck by a  
downwardly projecting bracket for rotation about the second transversely extending  
axis.

30 39. The apparatus of claim 35, wherein the inner frame includes  
first and second longitudinally extending siderails held in laterally spaced apart  
relationship by head end and foot end cross members, wherein the head end cross

member of the inner frame is fixed to the head end actuator, wherein the outer frame includes first and second longitudinally extending siderails held in laterally spaced apart relationship by head end and foot end cross members, wherein the foot ends of the inner and outer siderails are pivotally coupled to each other by a pair of pivot pins  
5 for rotation about the first transversely extending axis, wherein the underside of the upper deck is formed to include two longitudinally extending, laterally spaced guide grooves for receiving rim portions of a pair of wheels rotatably mounted on said pivot pins for rotation about the first transversely extending axis, and wherein the outer siderails are configured to form outwardly opening channels for receiving a pair of  
10 rollers mounted to the underside of the upper deck near the head end of the upper deck for rotation about the second transversely extending axis.

40. The apparatus of claim 39, wherein the foot end connector includes a cross member secured to the foot end actuator, an upwardly projecting bracket pivotally coupled to each end of the cross member for rotation about a third  
15 transversely extending axis, a pair of rollers coupled to each of the brackets, and a pair of longitudinally extending channels coupled to the underside of the upper deck near the foot end thereof for receiving the rollers.

41. The apparatus of claim 35, wherein the foot end connector includes a cross member secured to the foot end actuator, an upwardly projecting  
20 bracket pivotally coupled to each end of the cross member for rotation about a third pivot axis, at least one coupler coupled to each of the brackets, and a pair of longitudinally extending channels coupled to the underside of the upper deck near the foot end thereof for receiving the couplers.

42. The apparatus of claim 41, wherein the couplers are rollers.

25 43. The apparatus of claim 41, further including an upper deck locking mechanism comprising a longitudinally extending locking rod attached to the underside of the foot end of the upper deck near one side thereof, a clamp disposed about the rod and secured to the foot end cross member, and a release bar pivotally mounted to the base adjacent to said one side and coupled to the clamp, and wherein  
30 the clamp frees the upper deck to move longitudinally relative to the base in response to actuation of the release bar.

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44. The apparatus of claim 43, wherein the upper deck locking mechanism includes a cable coupled to the release bar and coupled to the clamp.

45. A patient support apparatus comprising:  
an elongated base having first and second ends,  
5 an upper deck having first and second ends and a longitudinal axis,  
first and second actuators coupled to the base adjacent to the first and second ends respectively,  
a first connector for coupling the first end of the upper deck to the first actuator, the first actuator controlling a vertical position of the first end of the upper  
10 deck, and  
a second connector for coupling the second end of the upper deck to the second actuator, the second actuator controlling a vertical position of the second end of the upper deck, the second connector including a cross member secured to the second actuator, an upwardly projecting bracket pivotally coupled to each end of the  
15 cross member for rotation about a transversely extending axis, at least one coupler coupled to each of the brackets, and a pair of longitudinally extending channels coupled to the underside of the upper deck near the second end thereof for receiving the couplers.

46. The apparatus of claim 45, wherein the couplers are rollers.  
20 47. The apparatus of claim 45, wherein the first and second connectors secure the upper deck to the base while allowing (a) translation of the upper deck toward the second end of the base, (aa) movement of the upper deck between a lowered position and a raised position, and (aaa) rotation of the upper deck between a first position where the second end of the upper deck is raised above the  
25 first end thereof and a second position where the first end of the upper deck is raised above the second end thereof.

48. A patient support apparatus comprising:  
an elongated base having a head end and a foot end,  
an upper deck having a head end, a foot end and a longitudinal axis,  
30 head end and foot end actuators coupled to the base adjacent to the head and foot ends respectively,

a head end connector for coupling the head end of the upper deck to the head end actuator, the head end actuator controlling a vertical position of the head end of the upper deck, and

a foot end connector for coupling the foot end of the upper deck to the  
5 foot end actuator, the foot end actuator controlling a vertical position of the foot end of the upper deck, and the foot end connector including a cross member secured to the foot end actuator, an upwardly projecting bracket pivotally coupled to each end of the cross member for rotation about a transversely extending axis, at least one coupler coupled to each of the brackets, and a pair of longitudinally extending channels  
10 coupled to the underside of the upper deck near the foot end thereof for receiving the couplers.

49. The apparatus of claim 48, wherein the couplers are rollers.

50. The apparatus of claim 48, wherein the head end connector includes an inner frame nested inside an outer frame, wherein the inner frame is  
15 secured to the head end actuator, wherein the inner and outer frames are pivotally coupled to each other near their respective foot ends for rotation about a first transversely extending axis, wherein the upper deck is translatably and pivotally coupled to the head end of the outer frame for translation of the upper deck toward the foot end of the base and for rotation of the upper deck about a second transversely  
20 extending axis which is spaced from the first transversely extending axis toward the head end of the upper deck.

51. The apparatus of claim 50, wherein both the inner and outer frames are configured to be generally rectangular, wherein the inner frame includes first and second longitudinally extending siderails held in laterally spaced apart  
25 relationship by head end and foot end cross members, wherein the head end cross member of the inner frame is fixed to the head end actuator, wherein the outer frame includes first and second longitudinally extending siderails held in laterally spaced apart relationship by head end and foot end cross members, wherein the foot ends of the inner and outer siderails are pivotally coupled to each other by a pair of pivot pins  
30 for rotation about the first transversely extending axis, wherein the underside of the upper deck is formed to include two longitudinally extending, laterally spaced guide grooves for receiving rim portions of a pair of wheels rotatably mounted on said pivot



pins for rotation about the first transversely extending axis, and wherein the outer siderails are configured to form outwardly opening channels for receiving a pair of rollers mounted to the underside of the upper deck near the head end of the upper deck for rotation about the second transversely extending axis.

5                   52.     The apparatus of claim 51, further including an upper deck locking mechanism, wherein the upper deck locking mechanism includes a longitudinally extending locking rod attached to the underside of the foot end of the upper deck near one side thereof, a clamp disposed about the rod and secured to the foot end cross member, and a release bar pivotally mounted to the base adjacent to  
10   said one side and coupled to the clamp, and wherein the clamp frees the upper deck to move longitudinally relative to the base when the release bar is actuated.

                  53.     The apparatus of claim 52, wherein the upper deck locking mechanism includes a cable coupled to the release bar and coupled to the clamp.

                  54.     A patient support apparatus comprising:  
15                   an elongated base having a head end and a foot end,  
                  an upper deck having a head end and a foot end, the upper deck being formed to include a cutout adjacent to the head end thereof to provide space for a patient's face lying in a prone position on the upper deck,  
                  head end and foot end actuators coupled to the base adjacent to the  
20   head and foot ends respectively,  
                  a head end connector for coupling the head end of the upper deck to the head end actuator, the head end actuator controlling a vertical position of the head end of the upper deck, and  
                  a foot end connector for coupling the foot end of the upper deck to the  
25   foot end actuator, the foot end actuator controlling a vertical position of the foot end of the upper deck, the head end and foot end connectors securing the upper deck to the base while allowing movement of the upper deck toward the foot end of the base to locate said cutout between the head end and foot end actuators.

                  55.     The apparatus of claim 54, wherein the upper deck is  
30   radiolucent, and wherein the head end and foot end connectors are spaced apart to define a central imaging region above the base between the head and foot end

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actuators which is free of any structure that would interfere with imaging of a patient supported on the upper deck.

56. A patient support apparatus comprising:
- an elongated base,
- 5 an upper deck coupled to the base, and having a head end, a foot end, and first and second sides,
- a transversely extending cross bar coupled to the upper deck near the head end, and
- a pair of armboards pivotally coupled to ends of the cross bar adjacent
- 10 to the two sides of the deck for movement between a first position extending toward the foot end and a second position extending away from the foot end for supporting a patient's arms, the pivotally coupled armboards allowing patients lying in a prone position on the upper deck to position their arms over the head and still be supported by the armboards.

- 15 57. A patient support apparatus comprising
- a base,
- a pair of front wheel assemblies coupled to the base,
- a pair of rear wheel assemblies coupled to the base,
- a deck coupled to the base,
- 20 a pair of armboards coupled to the deck, each armboard positioned to overlie a respective one of the pair of front wheel assemblies, and
- a pair of handles coupled to the deck, each handle positioned to overlie a respective one of the pair of rear wheel assemblies.

58. The patient support apparatus of claim 57, wherein the front
- 25 wheel assemblies are spaced apart transversely by a first distance and the deck includes a pair of longitudinal sides that are spaced apart transversely by a second distance that is less than the first distance.

59. The patient support apparatus of claim 57, wherein the rear
- wheel assemblies are spaced apart transversely by a first distance and the deck
- 30 includes a pair of longitudinal sides that are spaced apart transversely by a second distance that is less than the first distance.

60. The patient support apparatus of claim 57, wherein the pair of handles include outer edges that are spaced apart transversely by a first distance and the deck includes a pair of longitudinal sides that are spaced apart transversely by a second distance that is less than the first distance.

5           61. The patient support apparatus of claim 57, wherein the pair of armboards include outer edges that are spaced apart transversely by a first distance and the deck includes a pair of longitudinal sides that are spaced apart transversely by a second distance that is less than the first distance.

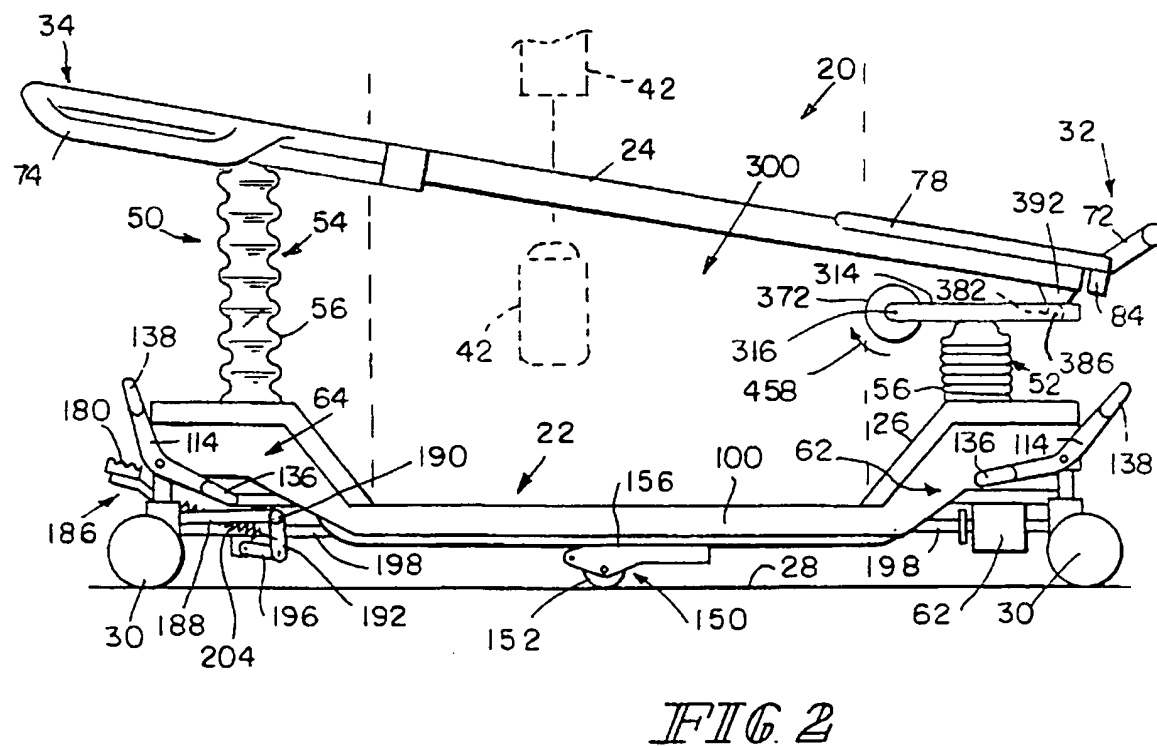
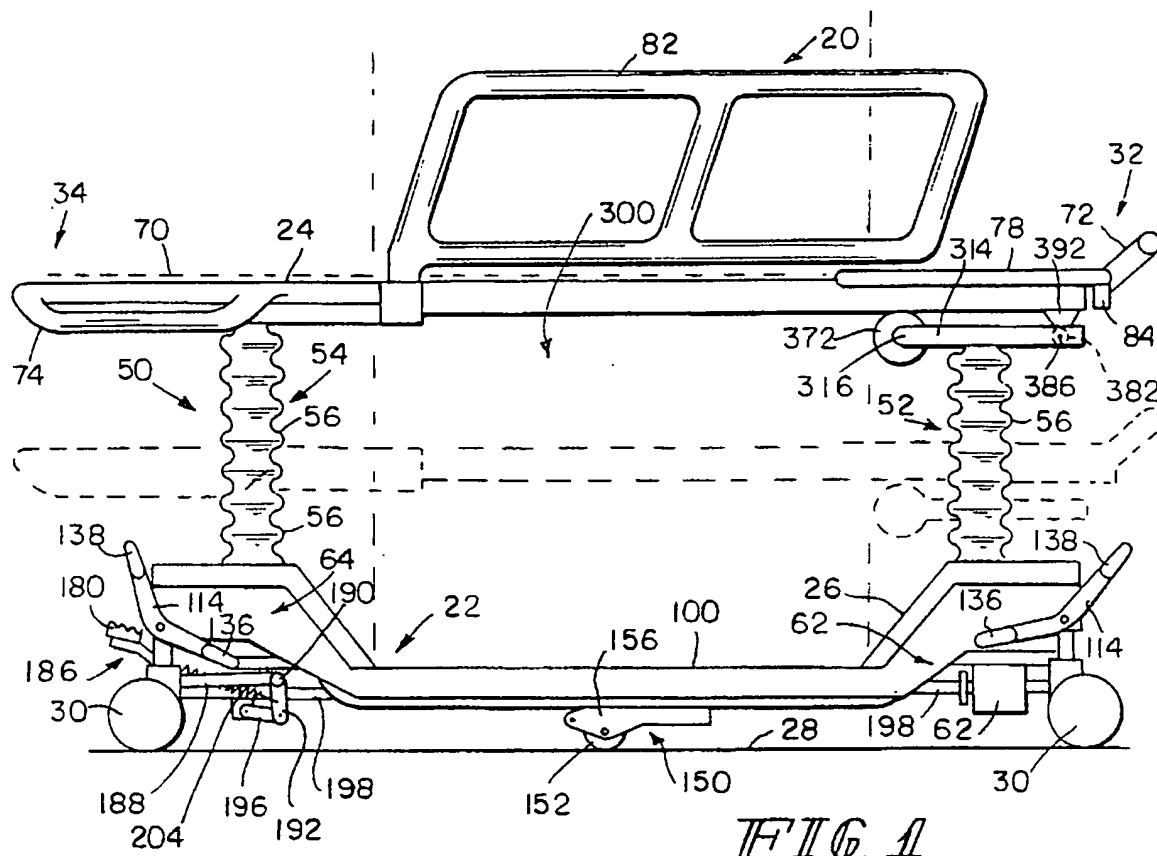
10           62. The patient support apparatus of claim 57, wherein each of the pair of armboards is coupled to the deck for pivoting movement.

63. The patient support apparatus of claim 57, wherein at least one of the pair of armboards is coupled to the deck for pivoting movement about a vertical axis.

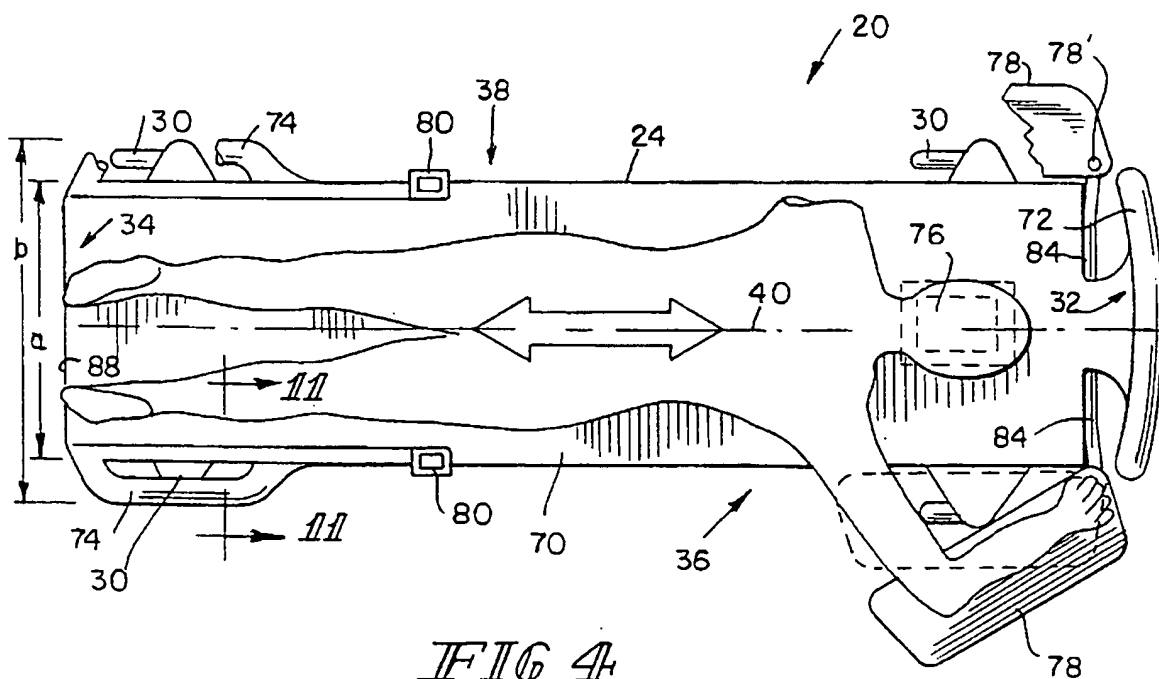
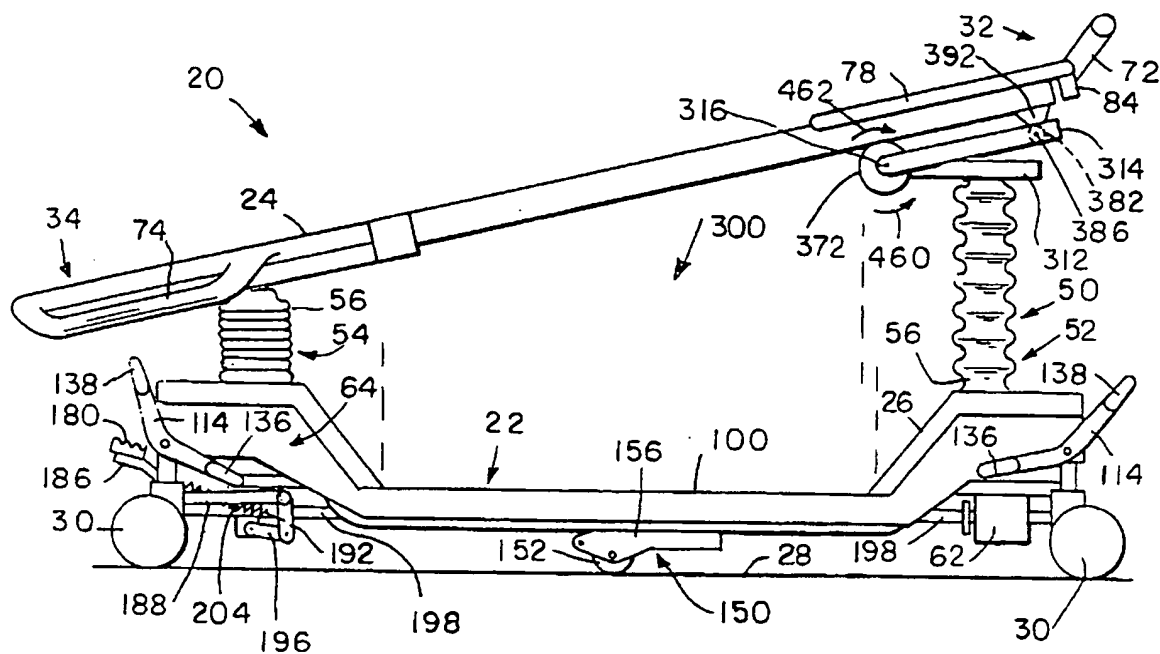
15           64. The patient support apparatus of claim 57, wherein the pair of front wheel assemblies comprise casters.

65. The patient support apparatus of claim 57, wherein the pair of rear wheel assemblies comprise casters.

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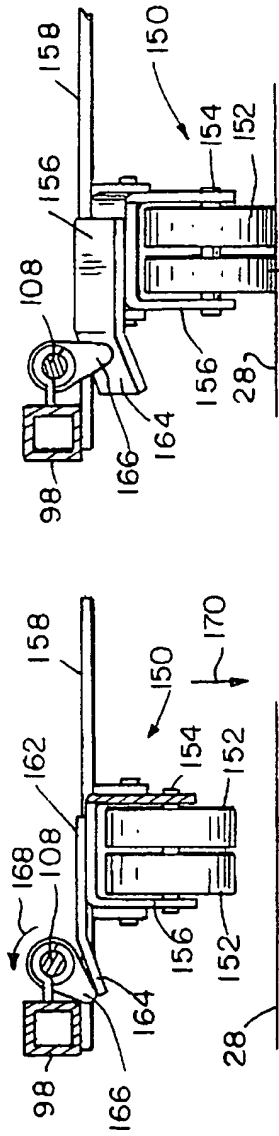


FIG. 1

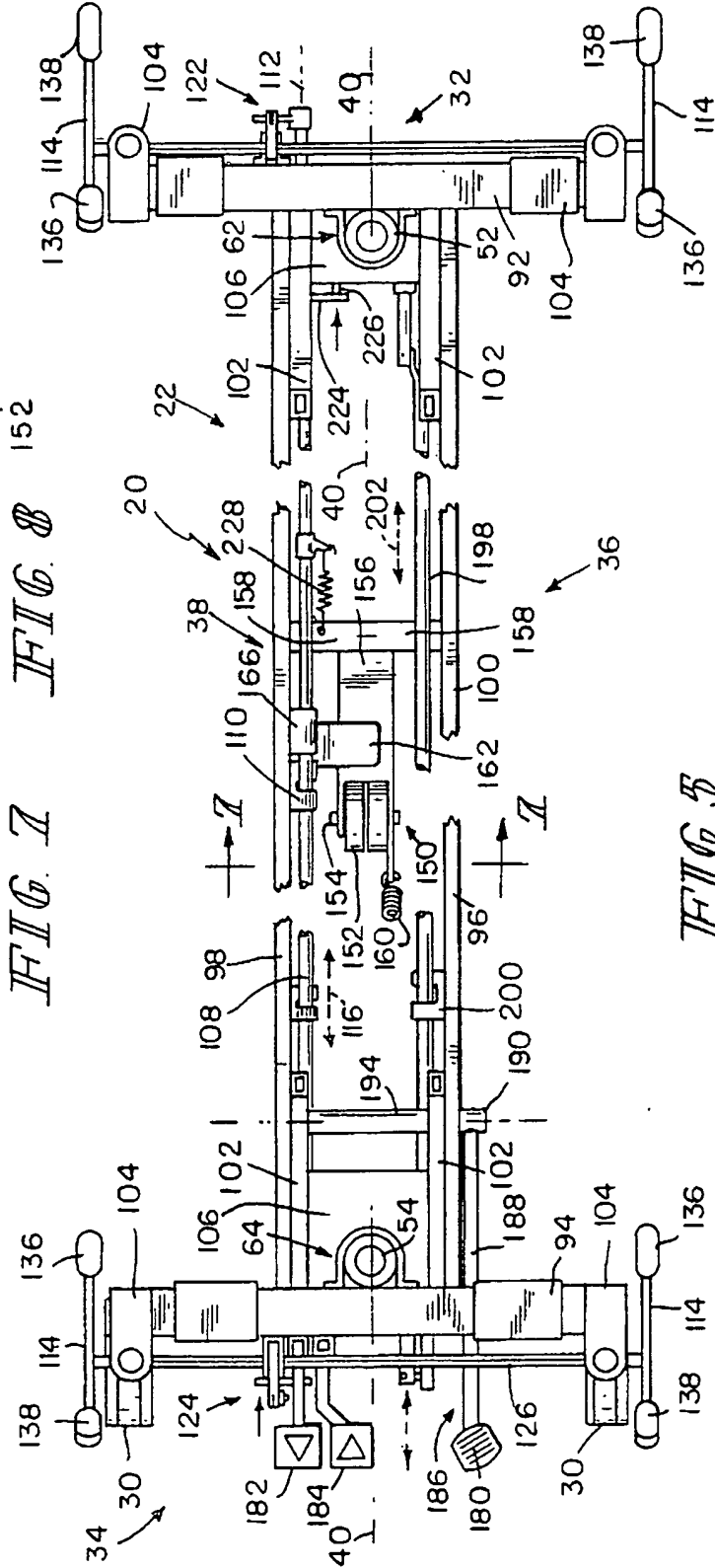
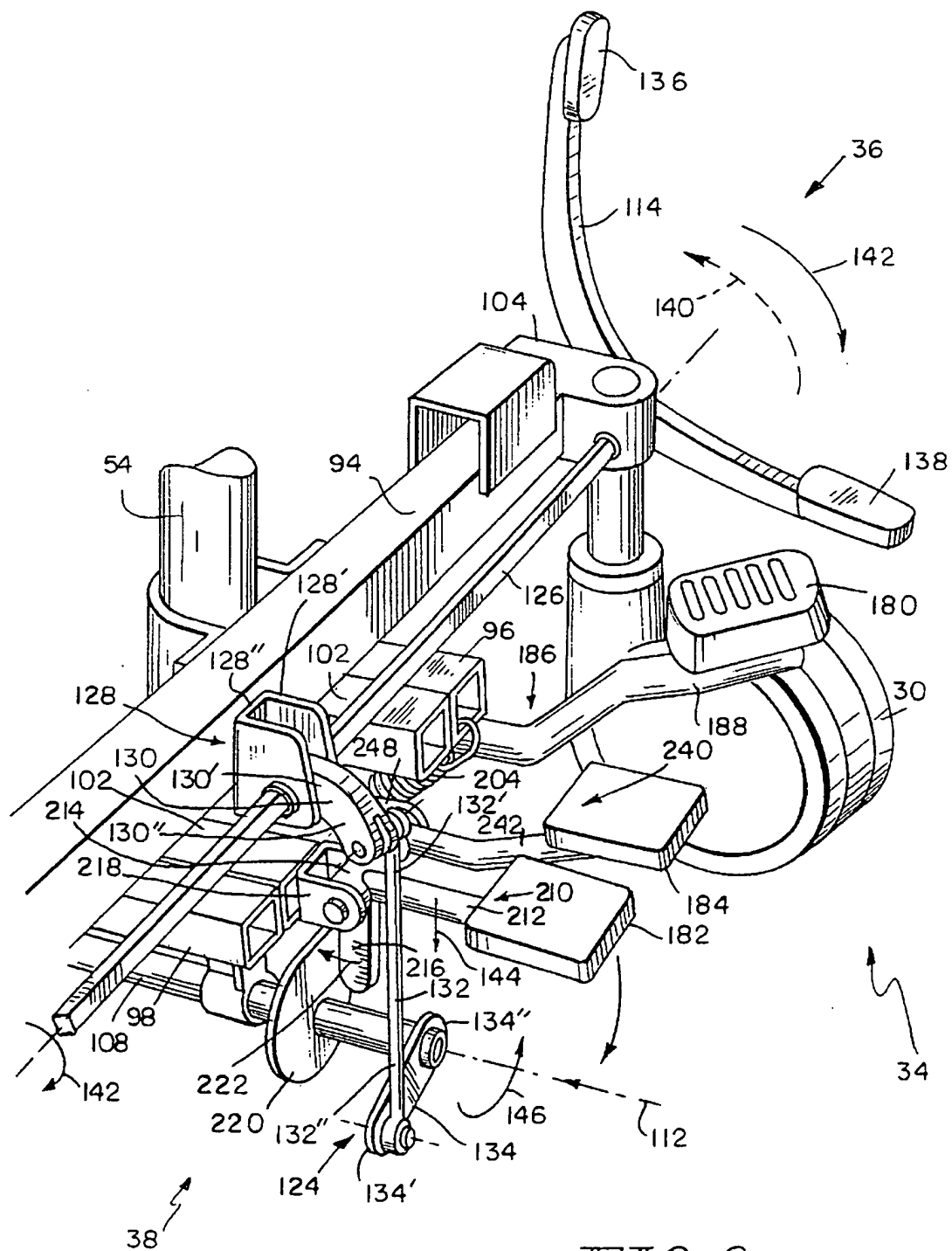


FIG. 3



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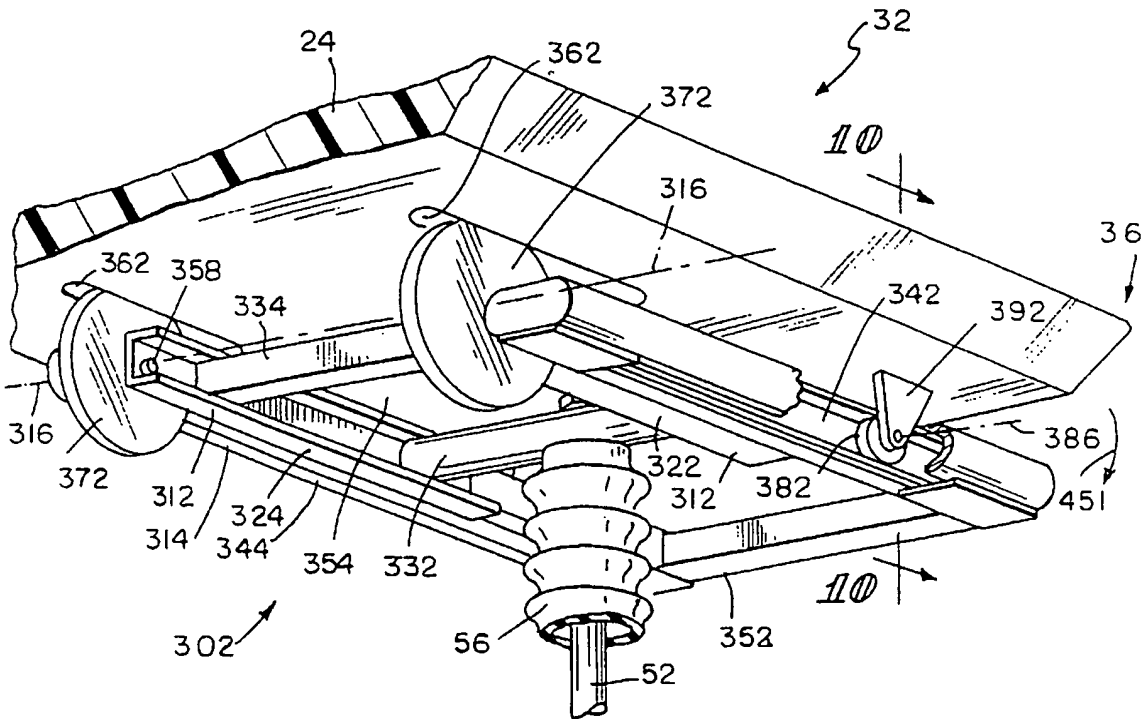


FIG. 9

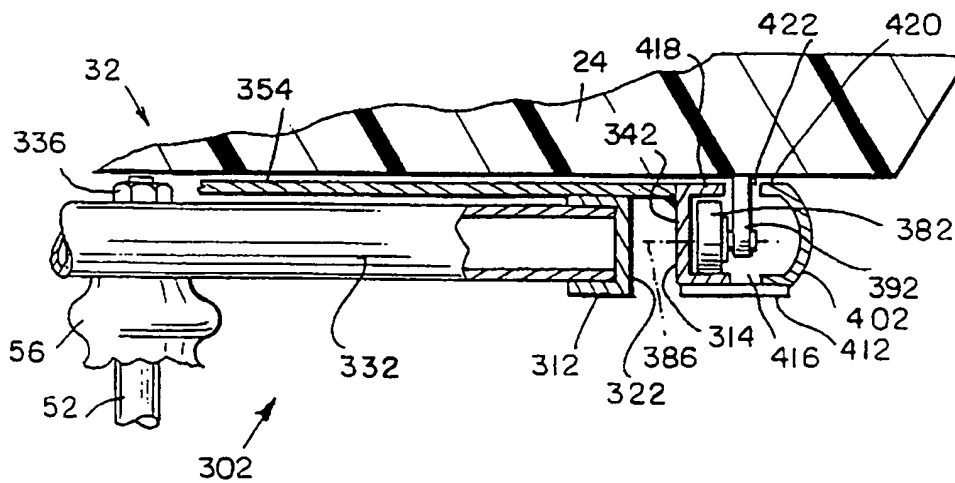
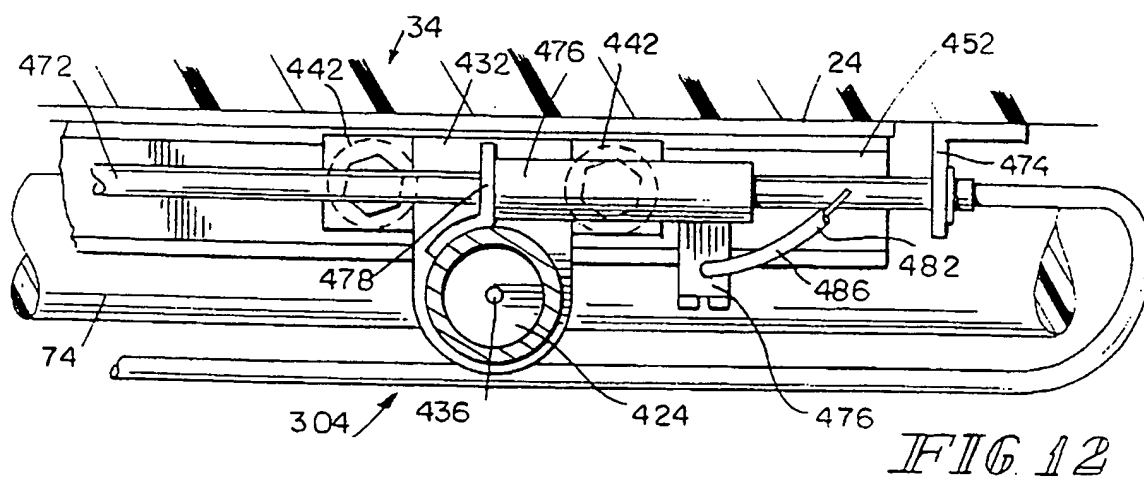
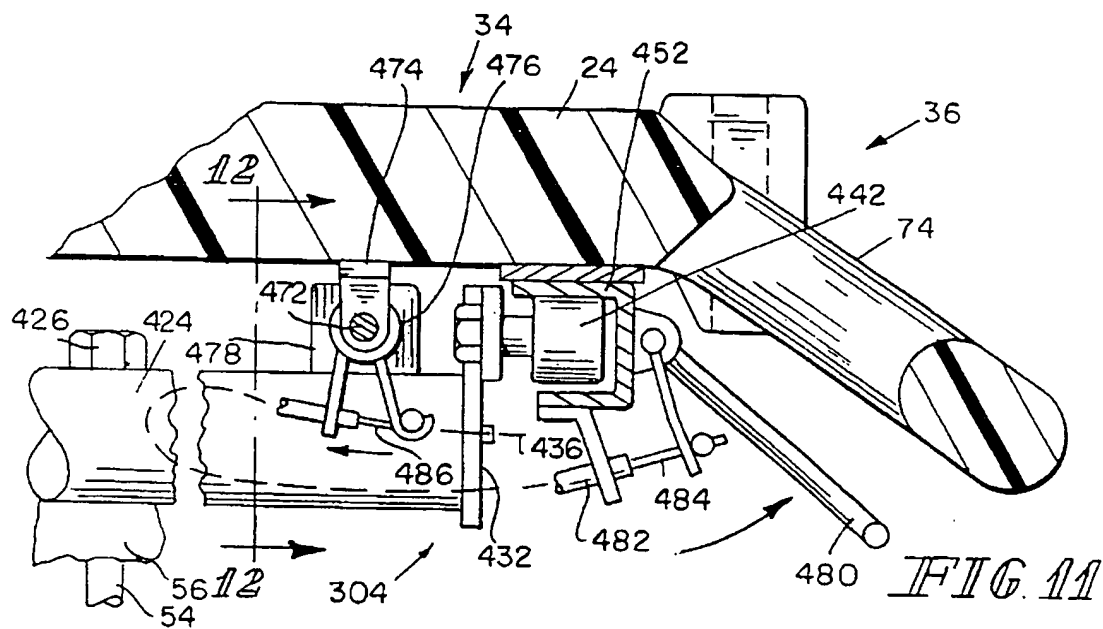


FIG. 10



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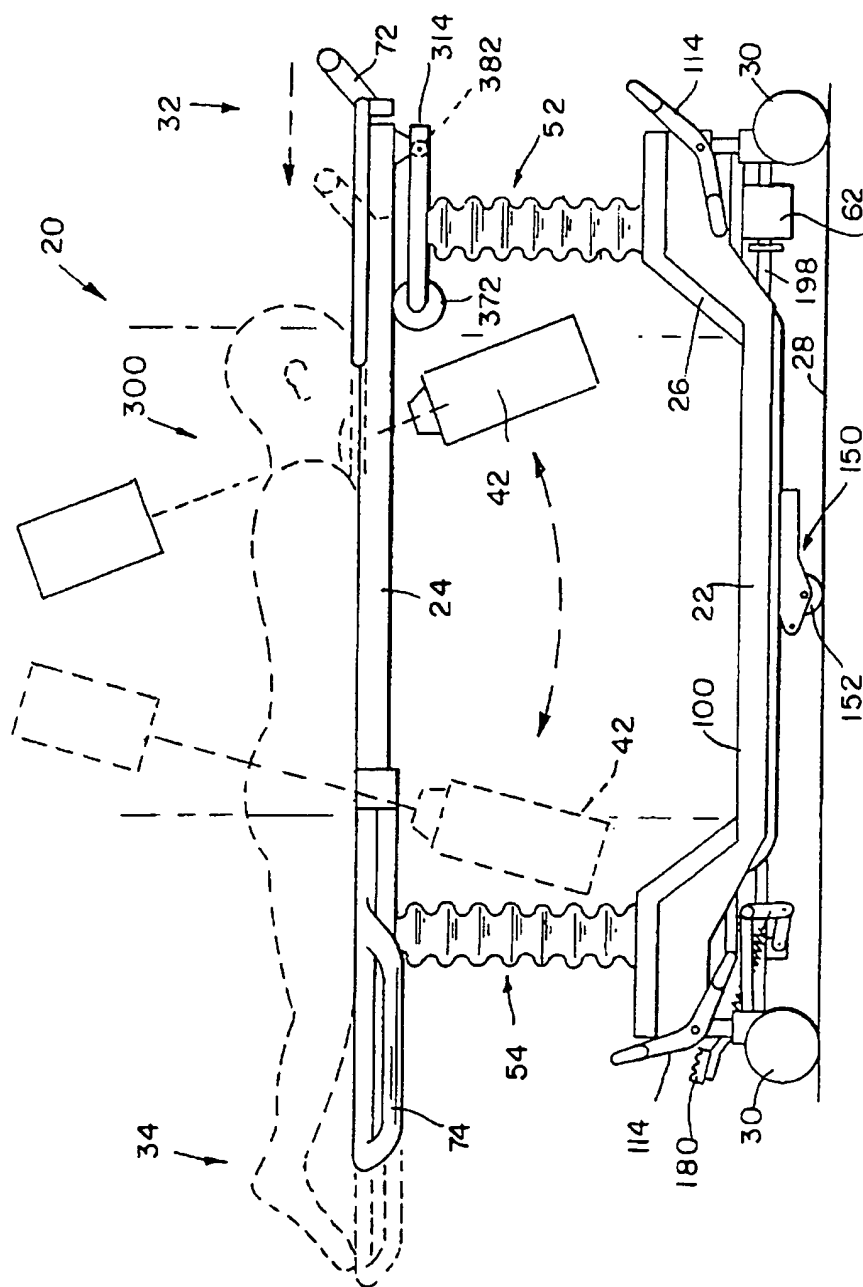
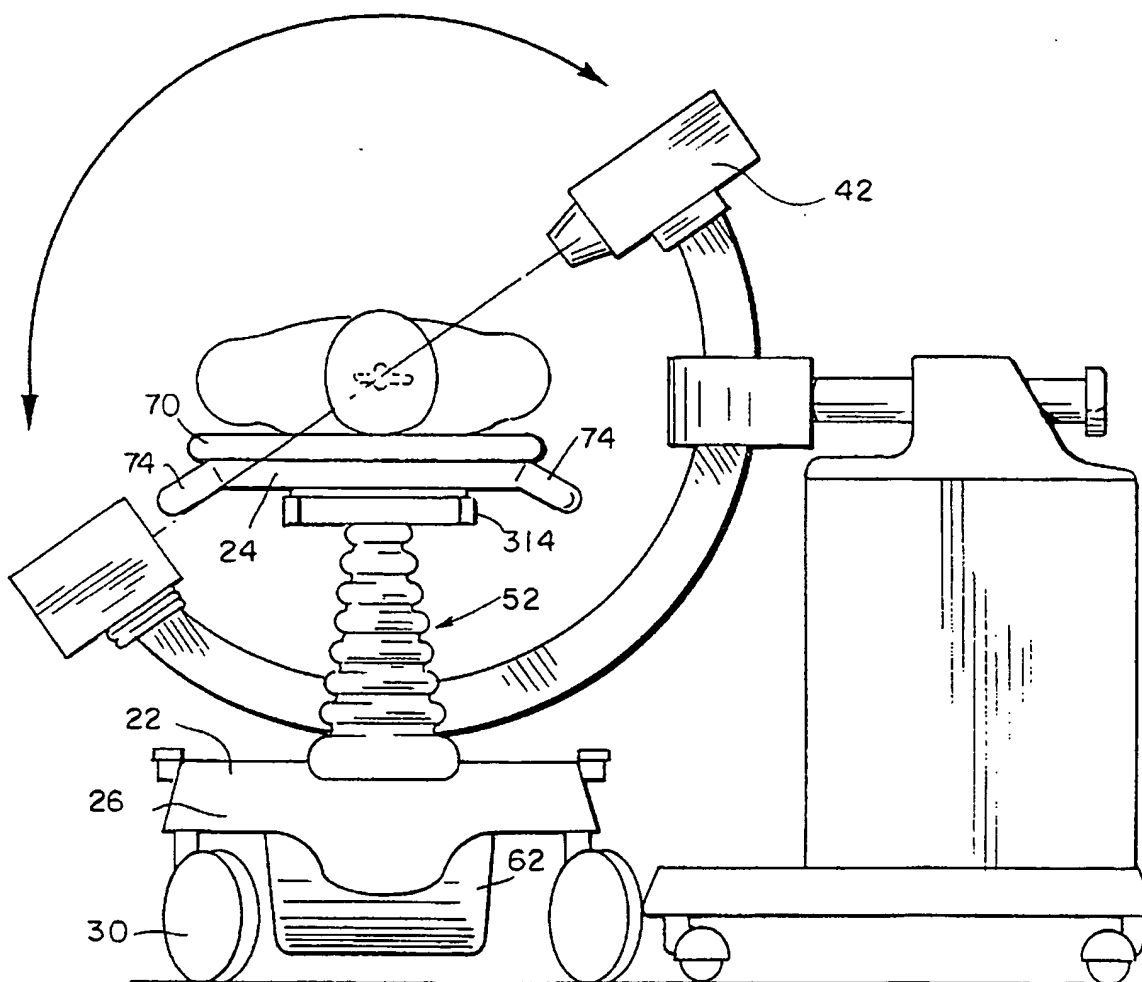


FIG. 13

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*FIG. 14*

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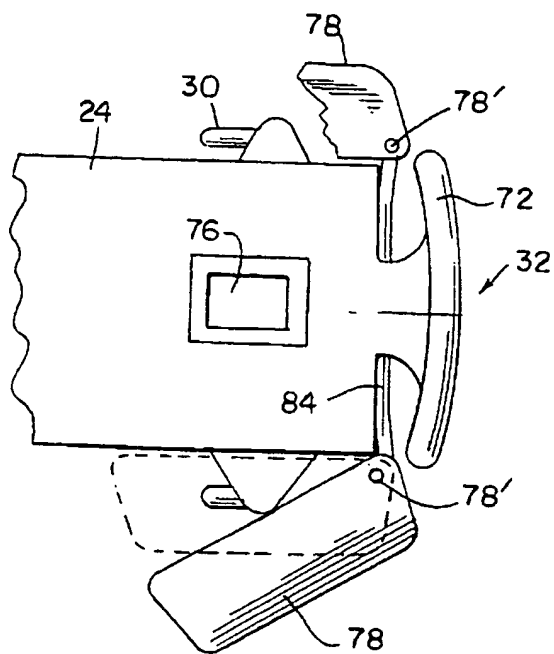


FIG 15

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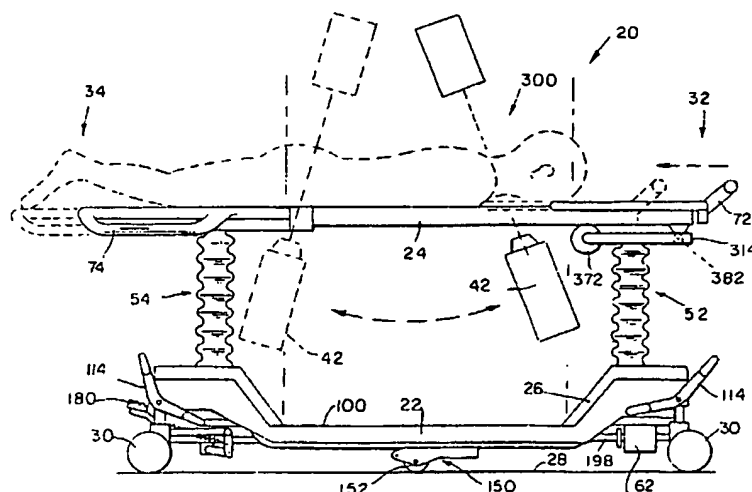
Published:

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(88) Date of publication of the international search report:  
20 June 2002

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: IMAGING STRETCHER



(57) Abstract: A stretcher (20) includes a base (22) having a head end (32) and a foot end (34), a plurality of casters (30) coupled to the base (22), a radiolucent upper deck (24), head and foot end hydraulic cylinders (52, 54) coupled to the base (22) adjacent to the head and foot ends (32, 34) thereof, and head and foot end connectors (302, 304) for coupling the head and foot end hydraulic cylinders (52, 54) to the head and foot ends (32, 34) of the deck (24). The head and foot end connectors (302, 304) secure the deck (24) to the base (22) while allowing movement of the deck (24) between a low position and a high position, translation of the deck (24) toward the foot end of the base (22), and rotation of the deck (24) to a Trendelenburg position or to a reverse Trendelenburg position. The stretcher (20) forms a central imaging region free of structure that would interfere with imaging.

WO 01/60308 A3

# INTERNATIONAL SEARCH REPORT

Int l Application No

PCT/US 01/40005

**A. CLASSIFICATION OF SUBJECT MATTER**  
 IPC 7 A61G13/00 A61G7/012

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A61G A61B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y	column 3, line 38 - line 41	57-62, 64,65
A	column 4, line 44 - line 66	19,21, 23,31, 54,55
	column 5, line 32 - line 49; claim 1; figures	
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A	column 6, line 29 - line 33; figures	18,33, 35,45,48
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Y	page 12, line 3 - line 9; figures	57-62, 64,65
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A	US 5 675 851 A (FEATHERS JOHN A) 14 October 1997 (1997-10-14) column 3, line 63 - line 67; figures	23,24, 54,55
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International Application No

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## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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# INTERNATIONAL SEARCH REPORT

national application No.  
PCT/US 01/40005

## Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2. ☐ Claims Nos.:  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
  
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

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2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
  
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
  
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/SA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-16

A patient support apparatus with adjustable first and second actuators for movably supporting the upper deck between a low position and a high position, and with a foot pedal mounted adjacent to the second end of the base, the pedal being configured to cause the first actuator to adjust the vertical position of the first end of the upper deck. (object: adjusting the vertical position of the upper deck with a foot pedal system)

2. Claims: 17-53

A patient support apparatus with adjustable first and second actuators for movably supporting the upper deck between a low position and a high position, and with head end and foot end connectors for respectively coupling the head end of the upper deck to the head end actuator and the foot end of the upper deck to the foot end actuator. (object: coupling one end of the upper deck to one respective actuator).

3. Claims: 54,55

A patient support apparatus with adjustable first and second actuators for movably supporting the upper deck between a low position and a high position, the upper deck being configured with a cutout to provide space for a patient's face lying in a prone position. (object: providing space for a patient's face lying in a prone position on the upper deck).

4. Claims: 56-65

A patient support apparatus with adjustable first and second actuators for movably supporting the upper deck between a low position and a high position, the upper deck being configured with a pair of armboards. (object: supporting a patient's arms).

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCr/US 01/40005

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			US 6249923 B1	26-06-2001

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International Application No

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9903418	A	US 6108840 A	29-08-2000
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